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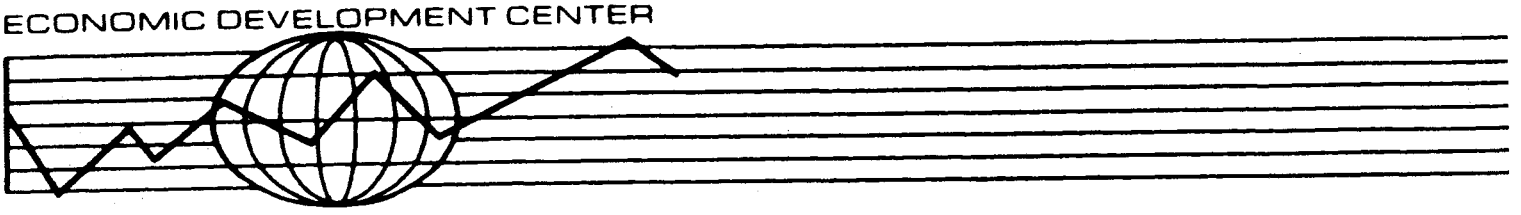

The Tunisian Fertilizer Distribution System - Structural and Policy Considerations

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Glossary of Abbreviations

CCGC	Central Cooperative for Cereal Crops
CIMMYT	Centro Internacional de Majoramiento de Maiz y Trigo
COCEBLE	Central Cooperative of Wheat
EEC	European Economic Community
FAO	Food and Agricultural Organization, United Nations
GIAF	Interprofessional Group of Citrus and Fruits
GOT	Government of Tunisia
NSP	Normal Superphosphate, 16% P_2O_5
OMVVM	Office of the Development of the Medjerda Valley
ONH	Office of Oils
OV	Office of Wine
SEPCM	Society of Chemical Products and Fertilizers of Megrine
SIAPE	Industrial Society of Phosphoric Acid and Fertilizer
SIDA	Swedish International Development Agency
SNCFT	National Tunisian Railroad Company
SRT	Regional Transport Society
STEC	Tunisian Society of Chemical Fertilizer
STIPCE	Industrial Tunisian Society of Chemical Products and Fertilizers
TD	Tunisian Dinars
TSP	Triple Superphosphate, 45% P_2O_5
TVA	Tennessee Valley Authority
UCCV	Central Cooperative Union of Grape Growers

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THE TUNISIAN FERTILIZER DISTRIBUTION SYSTEM - STRUCTURAL AND POLICY CONSIDERATIONS *

Dale L. Good and Jerome W. Hammond **

I. INTRODUCTION

The importance of increasing fertilizer use to meet production and productivity goals has been recognized within the Ministry of Agriculture and by the government's planning authorities in Tunisia for some time. The four year plan, 1969-72, stated that the Government of Tunisia's (GOT) 1/ long range agricultural production objectives for 1980 could not be met unless nitrogen (N) and phosphate (P_2O_5) consumption increased at an annual rate of 26.5 and 13.0 percent, respectively. It was estimated that the use level of nitrogen and phosphate should have been 48,000 and 50,000 metric tons, respectively, by 1972. In the latest four year plan, 1973-76, actual fertilizer use has been estimated for the agricultural crop year, 1972-73, to be only 28,200 metric tons of nitrogen and 28,900 metric tons of phosphate. To achieve the objectives of the 1973-76 plan, fertilizer needs of 85,000 metric tons of nitrogen, 47,000 metric tons of triple superphosphate, and 26,000 metric tons of normal superphosphate have been estimated for the crop year 1975-76. 2/

A number of programs and activities have been undertaken to expand fertilizer use. The Agricultural Extension Service has a program to include fertilizer demonstration plots in most gouvernorats. Television and radio broadcasts on fertilizer application are aired during fertilizer application periods. Rainfall data is collected in the north in order to more precisely estimate fertilizer needs. The prices of nitrogen and phosphate fertilizer have been brought under government control. The focus of most of these actions has been aimed at the northern region and, in particular, at wheat production.

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1/ GOT will be used to refer to the Government of Tunisia throughout this paper.

2/ Plan Quadriennal, 1973-76: La Production Agricole, Ministère de l'Agriculture, République Tunisienne, mars 1973, p. 22.

The adoption of the new high yielding wheat varieties that are highly fertilizer responsive is contributing to increased fertilizer use. The introduction of these new varieties into Tunisia began in 1966 when the GOT initiated a national wheat project with the support and assistance of the United States Agency for International Development (USAID), the Ford Foundation, and the Centro International de Mejoramiento de Maize y Trigo (CIMMYT).

Though the above actions have stimulated fertilizer use and increased the demand for fertilizers, especially nitrogen and phosphate fertilizers, increased fertilizer consumption is still constrained by several conditions. The agricultural four year development plan, 1973-76, lists these constraints as follows:

(1) The high price for fertilizer, especially that of locally produced fertilizer;

(2) Lack of farmer know-how in using fertilizers - specifically nitrogen;

(3) Lack of farmer conviction of the importance of using fertilizers;

(4) Producers, importers, and distributors of fertilizer not actively participating in the promotion of the use of fertilizers;

(5) The inefficient performance of the distribution system;

(6) Limited availability of credit;

(7) Climatic factors.

These factors can be considered under two major headings: (1) the factors affecting demand for fertilizer in Tunisia and (2) inefficiencies in the marketing and distribution channels for fertilizers. We will examine the fertilizer use problem with respect to these two dimensions.

Objectives

The purpose of this study was to examine some of the characteristics of fertilizer use, fertilizer pricing, and the distribution system. It should provide some insights on factors that influence the level of fertilizer use. A better understanding of the system should be useful to government officials, producers, and distributors of fertilizer in formulating policy and marketing decisions.

We have chosen the following specific objectives in order to explore the issues outlined above:

(1) To describe the past price and use patterns for fertilizer in Tunisia from aggregate market data;

(2) To describe the structure of the supply, marketing, and distribution system for fertilizer;

(3) To analyze government policies and programs that affect fertilizer distribution and level of fertilizer use.

Data Sources

The data for this study was drawn from two sources. Government documents (reports, planning documents, and statistical reports for Tunisia) provided much information on the kinds of problems and the evaluation of fertilizer use. An in-country survey was conducted between October 15, 1973 - April 15, 1974. During this period, government and fertilizer industry officials and public sector distributors were identified and interviewed and a survey was made of the public, private and cooperative retail outlets. Fertilizer shipment and price data were collected at all market levels. The survey was conducted to gather information on sales, prices, retailer chracteristics, costs, and consumption patterns and to identify critical problem areas. Since one company had a monopoly on the sales of phosphate fertilizers, it was reasoned that almost all retailers of fertilizer in Tunisia would number among its customers. This retail outlet population numbered 280. All outlets were stratified on the basis of fertilizer volume handled. A stratified random sample of 50 outlets was drawn. The respondents to the survey questionnaire numbered 47: 14 cooperatives, 18 cereal organizations, and 15 independent outlets.

Previous Studies

A number of other studies, in addition to the GOT planning documents, have dealt with the fertilizer market in Tunisia. In 1963, Robert Engle conducted a study on "The Use and Market of Fertilizer in Tunisia." 3/ This study examined the characteristics and problem areas of the market based primarily on secondary data. The study focused on fertilizer use. Consumption levels in 1963 by crop group were estimated. Forecasts of 1972 use were made. Alternative government policies were discussed along with soil analysis techniques and laboratory requirements to conduct soil analyses. The study focuses more on solutions to specific problems than on detailed description and analysis of the marketing system.

3/ Engle, R.A., Etude sur l'Utilisation et le Marché des Engrais en Tunisie, United States Agency for International Development, Tunis, Tunisia, 1963.

In 1968, the Tennessee Valley Authority conducted a study of the nitrogeneous fertilizer requirements and potentials for local production. 4/ This study estimated nitrogen needs for the wheat sector and considered the question of whether the GOT should meet their nitrogeneous requirements through importation or by domestic production.

In 1972, a Food and Agricultural Organization of the United Nations (FAO) report by C. Coursier and M. Jeandrain 5/ devotes several pages to a brief, but up-to-date, description of fertilizer use and distribution in Tunisia. They assembled data on fertilizer consumption and partially described the distribution system. It mentions the various problem areas of the market as outlined by the government.

4/ Tunisia - Nitrogen Fertilizer Needs, Alternatives to Meet Needs, Tennessee Valley Authority, Muscle Shoals, Alabama, 1968.

5/ Coursier, C. and Jeandrain, M. Rapport au Gouvernement de la Tunisie, Programme Engrais FAO, Organization des Nations Unis pour l'Alimentation et l'Agriculture, Rome, 1972.

II. FERTILIZER DEMAND AND USE

Use Trends

Fertilizer consumption (N, P_2O_5,K_2O) in Tunisia increased 109.3 percent from 1966-73. Most of the increase came through the expanded consumption of nitrogen fertilizers and continued increased in the use of phosphate fertilizer (Figure 1). The initiation of the GOT's wheat project in 1966 and price controls in 1970 were the two major factors contributing to the increase. Other contributing factors, according to retailers, were an increased availability of fertilizer and agricultural extension activities.

While total fertilizer consumption has increased, the rate of increase has lagged behind other developing countries. During the period 1966-71, the average rate of increase for all developing countries was 92.5 percent.6/ The world average was 42.0 percent. During this period, Tunisia's rate of increase was 72.5 percent.

The cereal sector has absorbed the largest portion of the increase in consumption. On the basis of retail fertilizer sales, the results of our survey indicate that presently 54.3 percent of the fertilizer is used in the cereal sector (49.3 percent in the wheat sector), 34.3 percent in the garden sector, 11.3 percent in the tree crop sector, and the balance on other miscellaneous crops.

Regional Use

On a regional basis, most of the fertilizer is used in the north where annual rainfall averages are the highest for the country. Figure 2 indicates the approximate levels of fertilizer use in five geographic regions of the country. We assume, of course, that the retail sales used for the calculations are a good estimation of fertilizer use.

Region I, which includes the four northeastern gouvernorats, is characterized by intensive and diversified agriculture. It is the major growing area in the country for garden, citrus, and grape crops. In 1973, 66.1 percent of the fertilizer retail sales in Tunisia occurred in this region. Approximately 18.3 percent of all sales were made by retailers in the capital, Tunis. Some of these sales were shipped to other regions (primarily Region II), but it was impossible to obtain an estimate of the amount that moved out of the region. Of the total sales, retailers estimated that 52 percent were applied to garden crops, 33.2 percent to cereals (29.0 percent to wheat), and 14.4 percent to tree crops.

6/ Fertilizers: An Annual Review of World Production and Consumption and Trade of Fertilizers, Food and Agricultural Organization, United Nations, Rome, 1972.

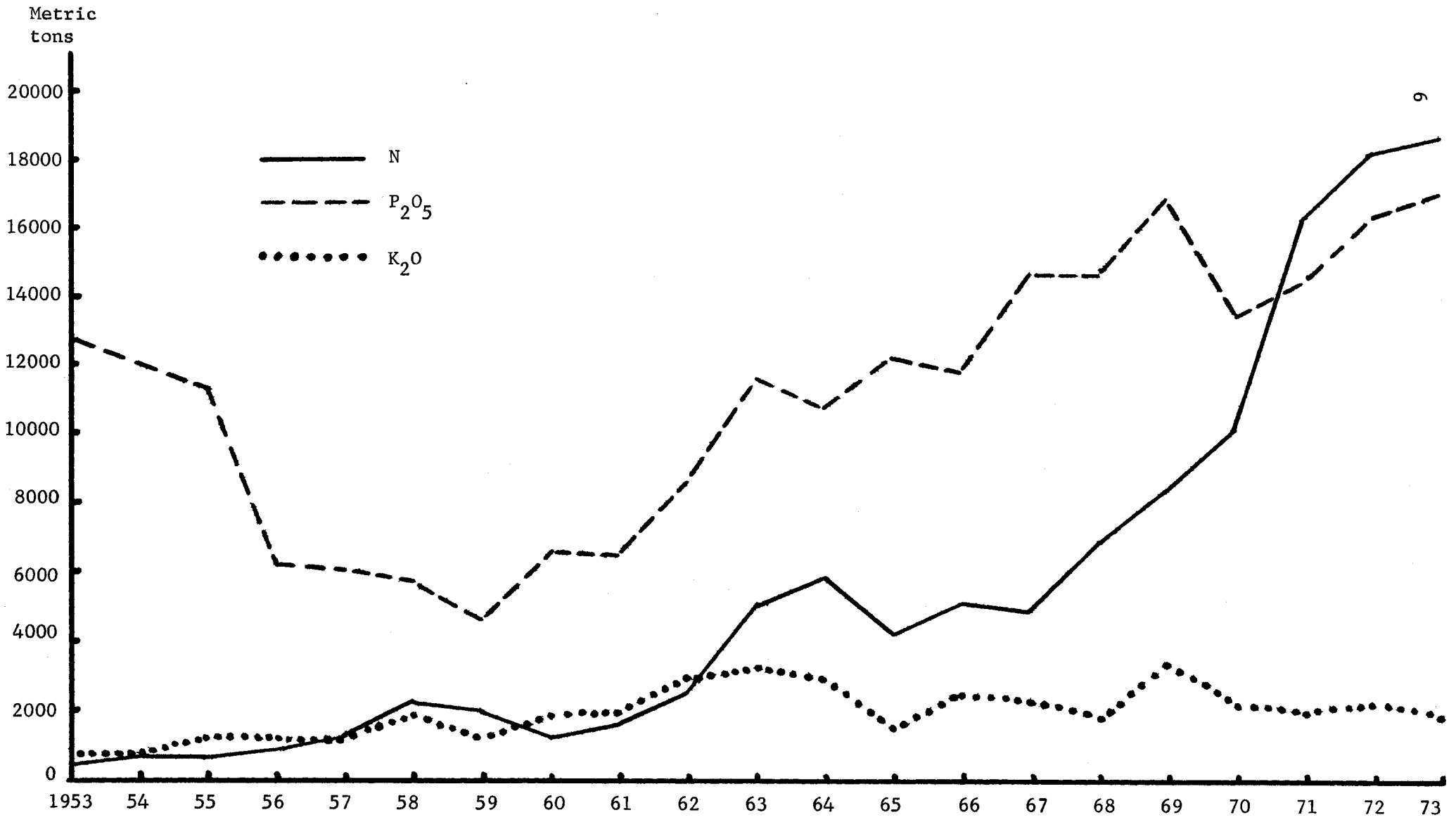

Figure 1. Fertilizer Consumption, 1973. 1/

1/ N, P_2O_5, and K_2O measured in pure nutrients.

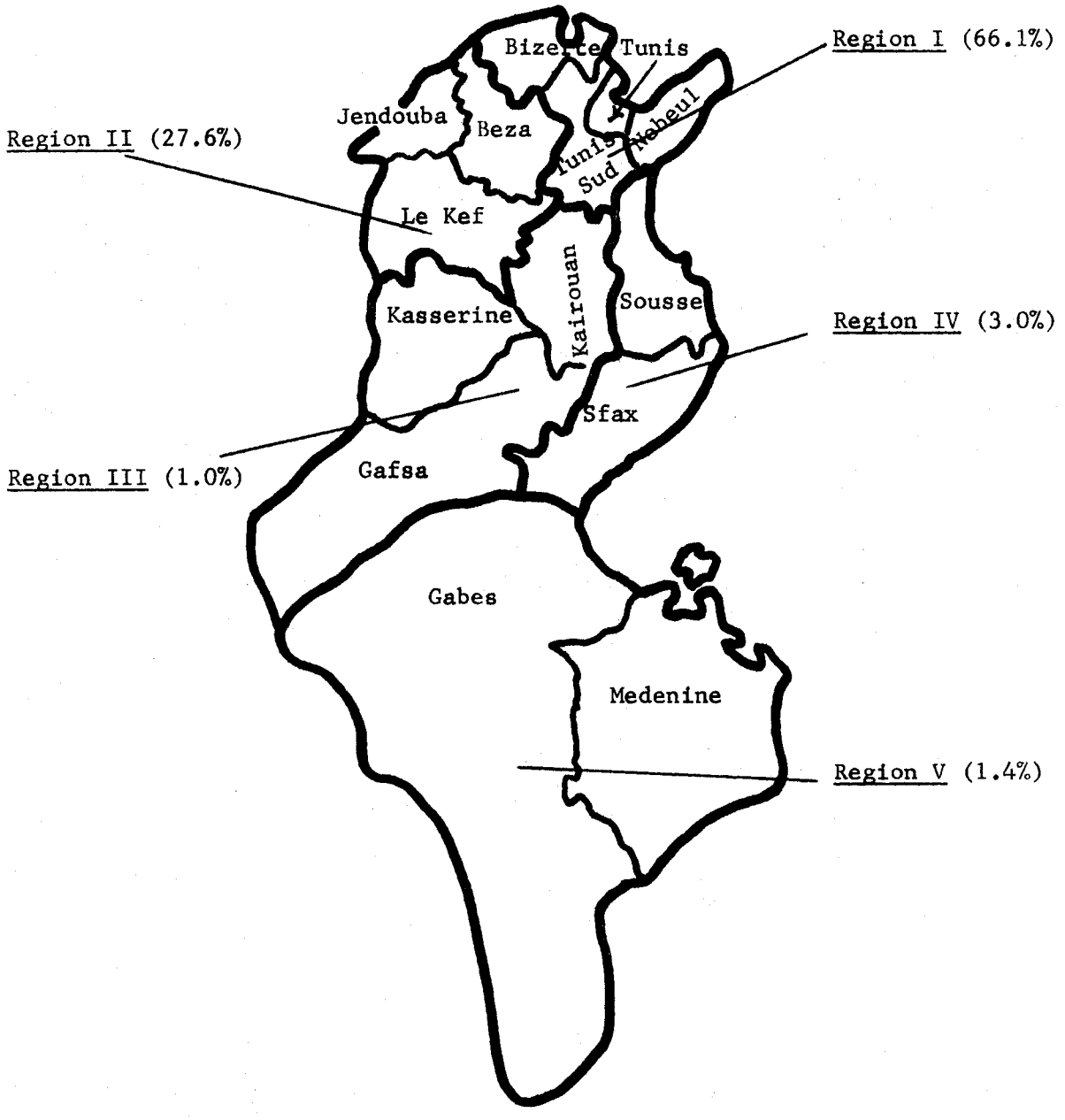

Figure 2. Fertilizer Sales in Tunisia by Regions, 1973.

The major agricultural activity in Region II, which includes the three northwestern gouvernorats, is cereal production. In 1973, 27.6 percent of all fertilizer retail sales occurred here. In addition, relatively large quantities of fertilizer for use in this region were purchased in Tunis. Thus, it is estimated that approximately 35 percent of all fertilizer use is accounted for in this region. Approximately 87.5 percent of the fertilizer sold in the region was used on cereal crops (75.4 percent on wheat), 8.3 percent on garden crops, and 4.3 percent on tree crops.

Region III, the three west central gouvernorats, is characterized by livestock grazing and olive production. The low level of rainfall in this region is not conducive to heavy fertilizer use. In 1973, only one percent of the fertilizer sales occurred here, and very little is used on cereal crops. One retail sales outlet in the gouvernorat of Kairouan estimated that 50 percent of its sales were applied on garden crops and 50 percent on tree crops.

Region IV, the two east central gouvernorats, is characterized by garden crops along the coastal areas in Sousse and olive production. In 1973, this region's sales accounted for approximately three percent of fertilizer sales. Ninety percent was applied to garden crops, 6.7 percent on tree crops, and 3.3 percent on cereals.

Region V, the two southern gouvernorats, has most crop activities located in the scattered oases; livestock grazing exists on an extensive scale. In 1973, 1.4 percent of the total fertilizer sales occurred in Region V. Fertilizer consumption is centered around the oasis of Gabes where garden crops are predominate.

Use by Type of Fertilizer

Nitrogen

When development planning was initiated in 1961, the consumption of nitrogen was 1,756 metric tons. By 1966, when the GOT initiated their wheat production project with CIMMYT, consumption had reached 4,102 metric tons. Since 1966, nitrogen fertilizer consumption has increased 356 percent. The percentage use of nitrogen by crop in 1971-72 was estimated to be: cereals - 50 percent, garden crops - 20 percent, tree crops - 25 percent, and others - 5 percent.

Increased use on cereal and garden crops can be expected as farmers become more aware of fertilizer's ability to increase net returns. The tree crop sector is likely to account for a larger percentage share because of new fertilizer extension and credit programs of the National Oils Office in the olive tree sector.

Phosphate

Phosphate consumption increased 82 percent from 1961 to 1966. The wheat production program and associated extension activities did not bring about the large increases in the use of phosphates as they did with nitrogen fertilizers. Since 1966, its use has increased 46 percent either because its use was already high or because wheat may not be as responsive to P as to N.

Phosphate use during 1971-72, according to government estimates, was the greatest on cereal crops, 70 percent of total use, with 20 percent used on garden crops, six percent on tree crops, and four percent on other crops.

Potassium

Potassium fertilizer consumption in 1961 was 2,025 metric tons. Since 1961, consumption has fluctuated from year to year with the use level in 1973 approximating that of 1961.

Two reasons have been advanced by the GOT for the lack of growth in potassium fertilizer consumption:

(1) Price increases for potassium fertilizer may have discouraged increased use. Its price has risen each year since 1971. While prices of nitrogen and phosphate fertilizers are now controlled, that of potassium is not.

(2) Fertilizer trials in Tunisia have not demonstrated a need for use of potassium on wheat.

The 1971-72 actual use estimates show potassium consumption to be allocated among crop groups as follows: cereal - 0.0 percent, garden crops - 50 percent, tree crops - 40 percent, and other crops - 10 percent.

Mixed Fertilizers

In the past, fertilizers had been hand mixed at the retail and farm level but are presently mixed only by producers/wholesalers. Little effort has been made to monitor the mixed fertilizer market. Demand estimates are not made by the Ministry of Agriculture for mixed fertilizer. Historical production records reveal that a 21.4 percent increase in production occurred between 1961 and 1973. Engle estimated that consumption was 1,415 metric tons in 1961, which is considerably less than the production of 8,400 metric tons listed by the Ministry of Planning for the same year. 7/ Evidence suggests that consumption of

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7/ Engle, p. 68.

mixed fertilizers has increased little in the past decade.

This may be partly due to the absence of price controls and subsequent price increases. Further, the nature of demand is such that good sound recommendations for use are not available and the more established materials are a better buy. The principle fertilizer mix sold in Tunisia is 6-8-8, which accounts for approximately 70 percent of all mixed sales and is an extremely low analysis mix even for Tunisia. In 1973, mixed fertilizer sales accounted for less than 10 percent of all fertilizer sales.

Estimation and Projection of Optimum Use and Demand for Fertilizer

The Ministry of Agriculture projects national fertilizer demand for each agricultural year (July-June). National commodity offices and several agricultural agencies recommend to farmers rates of fertilization on specific crops, based on fertilizer field trials and demonstrations. Some of these estimates and recommended optimums are described below.

Fertilizer Goals

A seminar was held at Sfax in 1969 to discuss the low level of fertilizer use in Tunisia. A product of that seminar was an "optimal" estimate of use for Tunisia. These optimum estimates have become informal fertilization goals. Actual and optimal use of fertilizer for the 1969-70 crop season and fertilizer use were presented. The theoretical optimum survey assumed "that all agricultural lands are owned by cooperative enterprises (the cooperative movement was quite strong at this time) using modern farming and fertilization methods thoroughly tested under local conditions during the last several years". The estimates in nutrient units were:

N	40,500	metric	tons
P_2O_5	54,578	"	"
K_2O	9,024	"	"

The survey report did not define whether these "optimums" were economic or agronomic optimums.

The estimate on actual use was based on observations made during the preceding years. A comparison of the two surveys revealed that actual use of N, P_2O_5, and K_2O were, respectively, 49 percent, 69.3 percent, and 67.2 percent of the optimum. 8/

8/ Colloque sur la Production, la Distribution et l'Utilisation des Engrais, (Proceedings of Seminar), Sfax, 18 et 19 avril 1969.

The use of the theoretical optimums as reference points and/or goals has several weaknesses:

(1) If it is purely agronomic and does not consider the price relationships of products and fertilizer prices, its use may be misleading. As discussed in the previous section, the level of fertilizer use depends partially on fertilizer prices. Only if the price and costs of fertilizer use are zero would a farmer use the agronomic optimum.

(2) If the estimates are economic optimums, they are valid only so long as product and fertilizer prices do not change.

(3) The cropping patterns of farmers have changed, thus implying changes in total fertilizer requirements.

The Ministry of Agriculture's Estimates and Projections

The Sub-committee on Agricultural Inputs is the agency within the Ministry of Agriculture which projects fertilizer consumption at the national level. These projections are made within a framework of development plans. In the latest four year development plan, 1973-76, projections were based on the estimated number of hectares planted to each crop and new areas expected to come under fertilization. Use by crop was projected by multiplying the area to come under fertilization by an estimated average application rate per hectare. The average application rates and product and fertilizer prices were assumed to remain unchanged over the period of the plan.

Projections of use for each succeeding year appear to be adjusted only to changes in crop patterns and area expected to come under fertilization. Historical consumption data and fertilizer and product price changes do not enter into the yearly adjustment calculations.

The margins between realized consumption levels and projected needs have not been considered in use projections. For the 1972-73 crop year, actual levels of ammonium nitrate and superphosphate use were only 46.1 percent and 58.6 percent, respectively, of projected use, Table 1. It seems that these discrepancies should be a guide to new projections. They may also signal the need for research on fertilizer demand and on the distribution system.

The use projections for the final year of the present plan, 1975-76, on a plant nutrient basis are considerably higher than actual consumption in 1973, Table 2. The projection for nitrogen consumption is 101.7 percent greater, phosphorous 149.2 percent, and potassium 275.0 percent. The plan projects a consumption level of fertilizer in 1975-76 that will be close to estimated optimum (Sfax seminar). Nitrogen consumption is projected to be 93.5 percent of the optimum level, phosphate 77.7 percent, and potassium 83.1 percent.

Table 1. Actual and Projected Fertilizer Use, 1971-72, 1972-73, 1973-74. 1/

Years	Actual Use		Projected Consumption		Actual Use as a Percent of Projected	
	Ammonium Nitrate	Superphosphate 45%	Ammonium Nitrate	Superphosphate 45%	Ammonium Nitrate	Superphosphate 45%
	metric tons					
1971-72	59,700	35,600	65,000	46,560	91.8	76.5
1972-73	40,000	38,511	86,800	65,700	46.1	58.6
1973-74	60,000	34,222	94,000	76,777	63.8	44.6

1/ The four year plan estimates for nitrogen and phosphorous are stated in terms of ammonium nitrate 33.5 percent and superphosphate 45 percent.

Source: Ministry of Agriculture.

Table 2. A Comparison of Actual, Estimated Optimal, and Projected Fertilizer Use in Tunisia, 1969-1976.

Year	N	P_2O_5	K_2O
	------ metric tons ------ (plant nutrient basis)		
Optimum (Sfax Seminar)			
1969	40,500	54,578	9,024
Consumption			
1973	18,768	17,014	2,000
Development Plan			
1972-73	25,795	29,350	5,000
1973-74	31,490	34,300	6,000
1974-75	34,170	38,800	6,500
1975-76	37,855	42,400	7,500

Source: Ministry of Agriculture, Colloque sur la Production, la Distribution et l'Utilisation des Engrais, and survey data.

Crop Sector Projections

The Ministry of Agriculture also makes the projections for crop sectors. The projected use by crop grouping for 1974-75, when compared to actual use estimates for 1971-72, indicates that cereals and industrial crops (primarily wheat) and tree crops are expected to account for most of the projected increase in fertilizer consumption, Table 3. Cereals and industrial crops are expected to account for 61.4 percent of the increase. Tree crops (primarily olive) are next with 35.4 percent, and garden crops arelast with 3.2 percent, Table 3. The cereal sector accounts for a large percentage of projected future increases in fertilizer consumption.

Estimates on a crop sector basis are also made by several other organizations. The Office of Cereals projects the needs of the cereals sector, the Interprofessional Group of Citrus and Fruit Growers for the citrus and fruit growers, the National Office of Oils for its projects in the olive sector, and the Office of Development of the Medjerda Valley for its members in the garden sector. Table 4 lists these organizations' projections for the crop year 1973-74.

Recommended Application Rates

The Wheat Project has conducted fertilizer trials for the last five years. On the basis of these trials, they have made recommendations on fertilizer application rates to farmers. Other fertilizer application

Table 3. Fertilizer Use Estimates by Crop Group in Tunisia, Actual Use 1971-72, Projected Use 1974-75.

	N		P_2O_5		K_2O		Total	
	1971-72	1974-75	1971-72	1974-75	1971-72	1974-75	1971-72	1974-75
	metric tons (plant nutrient basis)							
Cereals and Industrial Crops	11,000	20,100	11,850	27,925	250	250	23,100	48,275
Garden Crops	4,000	4,020	3,200	3,660	1,250	2,100	8,450	9,780
Tree Crops	5,000	10,050	950	7,215	1,000	4,200	6,956	21,465
TOTAL	20,000	34,170	16,000	38,800	2,500	6,550	38,500	79,520

Source: Ministry of Agriculture.

Table 4. Fertilizer Use Estimates of Several Government Agencies, 1973-74.

Organization	N	P_2O_5	K_2O
	------ metric tons ------ (plant nutrient basis)		
Office of Cereals (cereals)	12,680	14,727	---
National Office of Oils (olives)	3,350	---	---
Interprofessional Groups of Citrus Fruit Growers (citrus and fruit)	3,350	1,125	1,750
Office of Development Medjerda Valley (mainly garden crops)	612	1,033	665

Source: Office of Cereals, National Office of Oils, Interprofessional Group of Citrus Fruit Growers, and Office of Development Medjerda Valley.

recommendations were made in Capitaine's work in the 1960's [9/] and FAO's fertilizer program in the early 1970's. The Office of Cereals and the Agricultural Extension Service publish application rates for farmers' use.

The Office of Cereals' recommendations are calculated for rainfall level, the variety of wheat planted, and the preceding crop. Table 5 lists the range of their recommendations in comparison to the Ministry

Table 5. Actual and Recommended Rates of Fertilizer Application in the Cereal Sector, 1972.

Variety	Subcommittee Estimate of Actual Use Rates for 1972		Office of Cereals Recommendation	
	N	P_2O_5	N	P_2O_5
	---------- kilograms per hectare ----------			
HYV	50	45	44-112	30-45
Local	17	45	44-66	30-45

Source: Office of Cereals and Ministry of Agriculture.

9/ Capitaine, R. C., Fertilization Dans le cas d'un Type d'Assolement Céréalier en Tunisie, Annales de l'Institut National de la Récherche Agronomique en Tunisie, 1968.

of Agriculture's Subcommittee actual use estimates. The 1972 estimate for nitrogen actual use is at the lower range of recommended use for HYV's and substantially below the recommended rate for local varieties. Their phosphate estimates correspond with the maximum recommended by the Office of Cereals.

Very few studies have been conducted to determine the actual application rates of farmers. Two wheat studies 10/ have suggested that farmers do apply phosphate fertilizer at a rate close to the recommended levels, while application rates of nitrogen are close to one-half the recommended levels, Table 6.

Table 6. Fertilizer Consumption Based on a Field Survey of 22 Large Scale Farms in Northern Tunisia, 1972.

	Economic Optimum 1/	Actual Application Rates		
		Durum Wheat	Bread Wheat	Mexican Wheat
		--------- kilograms per hectare --------		
N	90	30.2	28.8	46.2
P_2O_5	45	30.2	47.7	41.0

1/ The Wheat Project Recommendation.

Sources: Malcolm Purvis, The Adoption of High Yielding Wheat Varieties in Tunisia, Staff Paper P72-7, Department of Agricultural and Applied Economics, University of Minnesota, February 1972; Republique Tunisienne, Norms, UCP Div. Nord 1969. SEPEN, S/SEA, Division de la Production Agricole, Mars 1969.

Table 7 evaluates the increased returns per hectare that are possible by increasing fertilizer use from average to recommended rates for Mateur with 1970-71 wheat and fertilizer prices. It reveals that the recommended rate is less than the economic optimum. The value of the additional output from increasing fertilizer use to recommended levels substantially exceeds the costs of the additional fertilizer (plus spreading costs). The cost is calculated at the retail fertilizer price of the Office of Cereals in Mateur. For bread wheat, net return would have been increased by 11.148 TD (Tunisian dinars) per hectare and by 7.299 TD per hectare for durum wheat. Though the figures do not permit determination of the precise level of use where net return would have been maximized, it does indicate that it was above the actual average levels of use.

10/ Rapport Annuel, Projet Blé, 1970-71; Malcolm J. Purvis, The Adoption of High Yielding Wheat Varieties in Tunisia, Staff Paper P72-7, Department of Agricultural and Applied Economics, University of Minnesota, February 1972.

Table 7. Impact of Applying Recommended Levels of Fertilizer Use on Wheat in Northern Tunis (Mateur area), 1970-71.

Variety of Wheat	Fertilizer Levels		Wheat Yield	Increased Value 1/	Increased Cost	Net Increase in Returns
	N	P_2O_5				
	------- kg per ha --------			---------- TD per ha ----------		
HYV Bread Wheat						
Average Actual	25.0	44.6	1,830	16.380	5.232	11.148
Recommended	68.6	44.6	2,220			
HYV Durum Wheat						
Average Actual	21.5	41.3	2,300	11.700	4.401	7.299
Recommended	51.8	48.8	2,560			

Source: Calculated from data in Rapport Annuel, Projet Blé, 1970-71.

1/ Calculated at 1970-71 wheat price less production tax.

Factors That Influence Fertilizer Demand and Use

Fertilizer use by Tunisian farmers is influenced by a variety of factors. First, prices are crucial for all farmers. This includes prices of farm products as well as the prices of the various fertilizers. Second, use is influenced by other costs associated with the use of fertilizer. That is, practices and costs that are not incurred by those farmers not using fertilizer - increased weed control, harvest costs, and interest on loans for fertilizer. These costs are often overlooked in calculating optimum levels of fertilizer use. Third, there are the annual weather variations that introduce additional risk elements into the production process for those farmers using fertilizer. Fourth, the level of farmer knowledge may be such that some producers may not be aware of the advantages of using fertilizer. Fifth, fertilizer may not always be available to farmers when needed. The following describes some of these considerations for Tunisia.

Price Policies

Fertilizer prices progressively increased in Tunisia through the 1960's, Table 8. Then in 1970, the GOT began to take a series of steps designed to lower the costs of agricultural production and stimulate the demand for fertilizer. Custom duties were abolished on nitrogen fertilizer and the production tax was lowered from 14.4 percent to 8.0 percent. In the same year, nitrogen and superphosphate fertilizer prices came under government control. Nitrogen prices were lowered and fixed on a per nutrient basis for each analysis.

In 1970, the retail price of triple superphosphate (TSP), 45 percent P_2O_5, was reduced from 41.690 TD to 36.000 TD per metric ton and the

Table 8. Fertilizer Prices in Tunisia - 1960, 1968-74.

Fertilizer Type	1960	1968	1969	1970	1971	1972	1973	1974 (Feb.)
	Tunisian dinars per metric ton							
Ammonium nitrate 33.5%	37.000	1/ 46.750	46.750	30.000	30.000	30.000	30.000	30.000
Potassium sulfate 48%	39.200	51.000	51.840	54.800	54.800	---	65.000	78.500
Normal superphosphate 16%	12.130	14.948	15.900	15.900	15.900	15.900	15.900	15.900
Triple superphosphate 45%	34.760	38.500	41.690	---	36.000	36.000	36.000	36.000
6-8-8	23.700	---	36.400	---	33.900	---	35.000	46.000

1/ 1962.

Source: Tunisian Society of Chemical Fertilizers.

normal superphosphate (NSP), 16 percent P_2O_5, retail price was fixed at the prevailing rate of 15.900 TD per metric ton. These prices remained unchanged until April of 1973 when the NSP retail price was increased to 17.550 TD. In September of 1973 the original retail price was reinstated and a subsidy was granted to the fertilizer producer, the Tunisian Society of Chemical Fertilizers (STEC).

In April 1974, as the world prices of nitrogen fertilizer increased, the GOT raised the internal price of ammonium nitrate 33.5 percent to 50.000 TD per metric ton. It was still necessary to subsidize the price of imported nitrogen because of higher external prices.

The unregulated prices for mixed and potassium fertilizer increased greatly over the period 1960-74. The retail price of 6-8-8, which is the principal mixed fertilizer sold in Tunisia, increased 94 percent and potassium sulfate prices increased 100 percent.

Nitrogen and superphosphate prices are controlled at both the wholesale and retail market levels. The policy consists of fixing the nitrogen and NSP wholesale and retail prices at the factory gate (or point of wholesale). The prices for both controlled and non-controlled fertilizers for February 1974 are listed in Table 9. A retailer

Table 9. Fertilizer Prices in Tunis, February 1974.

	Retail	Wholesale
	Tunisian dinars per metric ton	
Ammonium nitrate 33.5 1/	30.000	28.500
Ammonium nitrate lime 15.5 1/	21.550	20.050
Ammonium sulfate 21.0 1/	20.370	18.870
Urea 1/	33.580	32.080
NSP 1/	15.900	15.600
TSP 1/	36.000	34.500
Sulfate of potash 48.0	78.500	75.000
Malaxe El Kaomi	47.500	45.500
Themcen	27.100	25.100
6-8-8	46.000	44.000
0-12-12	51.000	49.000
0-12-38	61.500	59.500
10-10-16	72.000	70.000
12-8	60.000	58.000
12-12	47.000	45.000
12-38	61.500	59.500
15-6-8	62.000	60.000
24-24	60.000	58.000
12-12-20	55.500	53.500

Source: STEC.
1/ Wholesale and retail prices are controlled by the government (f.o.b. Tunis).

purchasing his supplies at the factory gate is allowed to add his transport and handling costs to the fixed retail price. Since there is no fixed schedule of transport and handling charges, retail prices are, in effect, not controlled at country points. The retail price for TSP is a rather peculiar arrangement. The retail price of TSP is fixed at a uniform rate throughout the country. If a retailer transports TSP by rail, the transport and handling costs are borne by the wholesaler. But, truck transport and associated handling costs are borne by the retailer. Thus, a retailer located near a rail line is in a lower cost position than one who is dependent on truck transport for his TSP shipments.

Subsidization

The subsidization of fertilizer use is aimed at lowering the costs of production. For nitrogen fertilizer, a subsidy is paid to importers. The importers must forward to the Ministry of National Economy a cost report for each shipment. The cost report is submitted after importation and subsidy payments are made and domestic sales have been completed. Products or imports that go unsold are not subsidized.

The timing of subsidy payments has an influence on the import decisions of importers. Under any pricing policy, they may want to minimize stock carryover. But under the present policy payment of subsidies where payment is made only after completion of domestic sales, importers desire to minimize stocks out-of-season and to time production and imports to peak demand periods. Rational operation of their business under such a policy has possibly created fertilizer shortages.

The direct costs of subsidy payments have been increasing. The government's budget in 1973 provided 298,500 TD for the subsidization of fertilizer. The initial provision was underestimated and an additional 1,500,000 TD was subsequently added to the budget. The 1974 budget allocated 2,900,000 TD for the subsidy. As early as February 1974, the Ministry of Agriculture estimated that price increases under the existing pricing policy would lead to an expenditure of 6,741,750 TD for the subsidization program. 11/ The Ministry of Agriculture also requested the subsidization of potassium sulfate at the cost of 195,000 TD.

The government fertilizer subsidy appears to have stimulated use. Between 1970 and 1973, the consumption of ammonium nitrate increased 317 percent, while at Tunis prices fell 34 percent. The consumption of NSP increased 10 percent, while its price remained unchanged. The consumption of TSP increased 27 percent; its price was lowered by 14 percent. Use of nonsubsidized fertilizer has either declined or held

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11/ This estimate was calculated using use estimates of the Ministry of Agriculture for 1974-75.

constant. The consumption of potassium sulfate fell 12 percent, while prices rose 44 percent. The consumption of 6-8-8 mixed fertilizer rose one percent, while prices increased 21 percent. It appears that the control of nitrogen and superphosphate prices and subsidies have insulated the Tunisian farmer from rising world prices for nitrogen and from increasing costs of production for superphosphates. 12/

Taxation

A production tax is levied on sales of all agricultural and manufacturing enterprises in Tunisia. Thus, taxes reduce the net price received for farm products and they increase the price of farm inputs. While the objective of taxes is to obtain necessary government revenue, they have an important impact on resource allocation. The GOT is aware of this and has reduced the taxes, but they still have an impact on net farm prices. The grape, cereal, and olive crops are taxed: 7.0, 6.0, and 5.0, respectively, Tables 10 and 11. Taxes are a disincentive

Table 10. Taxation of the Agricultural Sector, 1970, 1974.

Nature of Tax	1970	1974
	----- percent -----	
Wheat, Barley, Oats	7.7	6.0
Linseed, Corn, Sorghum	4.6	4.0
Olive	7.7	5.0
Grape	7.7	7.0
Other Products	5.0	3.0

Source: La Presse, 27 mars 1974.

Table 11. Base Farm Prices and Taxes to Farmers on Durum, Bread Wheat, and Barley in Tunisia, 1974.

	Durum	Bread Wheat	Barley
	------ TD per quintal ------		
Base Farm Price	6.100	5.500	4.000
Less Taxes	0.438	0.398	0.299
Net Farm Price 1/	5.662	5.102	3.701

Source: Study of the Tunisian Grain Marketing System, Food and Feed Grain Institute, Kansas State University, August 1974.
1/ Excluding transportation costs from farm to collection center.

12/ An analysis of the impacts of price fixing, subsidization, and taxes on levels of fertilizer use and the market participants is described in Chapter IV.

to the growers of crops whose products are important foreign exchange earners. In the case of wheat, a crop where production has not fulfilled domestic demand at controlled prices in recent years, foreign exchange expenditures for wheat imports are larger than they would have been without farm production taxes.

The tax on fertilizer production and imports leads to declines in use and consequently on crop production. A tax of 17 percent is levied on the production of superphosphates. The Ministry of Agriculture for the last several years has suggested that this tax be abolished or lowered, but no action has been taken. An eight percent production tax is levied on imported nitrogen. Taxes on both product and input in agriculture conflict with other policies or objectives of the GOT, specifically low food price policy, increased agricultural production and productivity, and improving the balance of payments position. Fertilizer producers and importers are taxed by the government and then subsidized by a large amount to stimulate greater use. While need for government revenue is obvious, other effects of taxes, such as reduced agricultural production, increased consumer prices, and the incidence of the tax are perhaps less obvious.

Rainfall Variation

Use of fertilizer is significantly influenced by rainfall, not only the quantity, but also the distribution of rainfall throughout the growing season. Since Tunisia is subject to extreme variation in the quantity and time of rainfall, annual fertilizer demands and use are subject to substantial variation.

Fertilizer needs and use are estimated by the Ministry of Agriculture. Phosphate use is during the period August-March, with 72 percent estimated for use on cereal and industrial crops from August through October. Cereal farmers are advised (by the agricultural extension service), depending upon region and previous cropping, to apply phosphate fertilizers during July, August, and September and to begin seeding in October. [13/] Their ability to do this depends on the timing and amount of rainfall. In Le Kef in 1968, rainfall totaled 6.7 mm during the months of July, August, and September; in comparison, in 1972 76 mm of rain fell.

The late arrival of the rainy season shifts as well as alters the level of phosphate application. In 1972, the Office of Cereals centers sold 70.2 percent of its superphosphate fertilizers during the August-October period. During the same period in 1973, they sold 43.2 percent. In Table 12, we can see both the extreme variation in rainfall and the monthly distribution for this period (August-October).

13/ Campagne Céréalière 1972-73, Division de la Vulgarization Agricole, Direction de la Production Agricole, Ministère de l'Agriculture, septembre 1972.

Table 12. Rainfall at Several Centers, August-October, 1972, 1973.

Center	1972			1973		
	August	September	October	August	September	October
	millimeters					
Mateur	3	56	45	5	7	63
Jendouba	9	98	77	58	10	64
Le Kef	--	65	111	24	NA	78
Makthar	35	60	134	33	3	64
Kasserine	19	35	75	25	12	11
Kairouan	10	59	78	29	2	18
Tunis	5	51	55	3	14	135
Bizerte	4	28	108	15	18	45

Source: Bulletin Mensuel de Statistique, Institut National de la Statistique, various issues.

The time and amount of rainfall is even more crucial to nitrogen application. R.C. Capitaine, in his fertilization trials in Tunisia during the 1960's illustrated the relation of the profitability of using nitrogen on wheat and the amount of rainfall. His work indicated that the side-dressing of wheat in January and February should not be undertaken unless rainfall exceeds 240 mm between September 1 and January 1.

If farmers had followed Capitaine's recommendations in 1972-73, they would have side-dressed wheat in the areas of Tunis, Bizerte, Mateur, Jendouba, Le Kef, Makthar, and Kairouan. In 1973-74, only those farmers in the areas of Tunis and Kairouan would have side-dressed. In an average year, the Ministry of Agriculture has determined that 52.4 percent of the nitrogen needs for cereals are during the months of January and February.

Availability of Fertilizer

The availability of fertilizer when needed by farmers also influences the level of use. First, farmers rarely carry their own stocks and are dependent on retail outlets to furnish them with fertilizer immediately prior to or at application times. Furthermore, the uncertainty of quantity of sales to farmers has led retailers to the practice of purchasing fertilizer from the wholesalers immediately prior to and during fertilizer application periods. Figure 3 reveals the seasonal nature of NSP sales of STEC. In 1973, STEC sold 51 percent of its superphosphate fertilizer (pure nutrient) during August-October and 33.9 percent during November-December. STEC's sales are heavily concentrated in the fall of the year for TSP and nitrogen fertilizer as well as NSP.

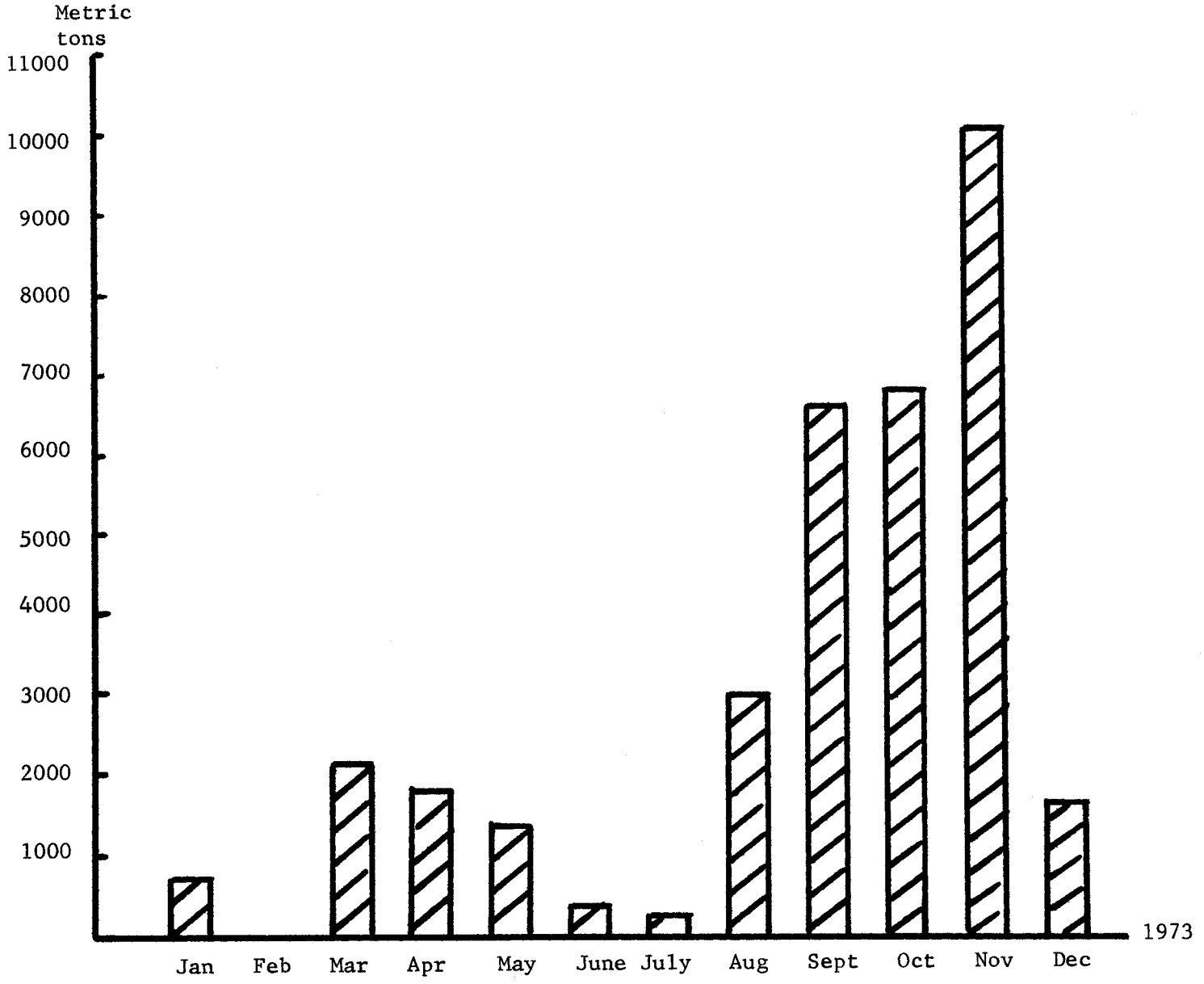


Figure 3. Monthly Sales of Normal Superphosphate by the Tunisian Society of Chemical Fertilizer, 1973.

Source: STEC.

Importers, because of uncertainty of sales, are reluctant to import substantial and perhaps adequate quantities of nitrogen fertilizers in advance of the crop season. Figure 4 reveals the timing of nitrogen imports in 1973. The months of high nitrogen use, December and January, are the months of largest imports. Thus, shortages can easily develop. Many retail outlets surveyed did report temporary nitrogen shortages.

On October 10, 1973, the cereals' organizations reported that they had stocks of 15,824 metric tons of ammonium nitrate. The Ministry of Agriculture estimated that the needs for the cereal sector during November through December would be 23,500 metric tons with a similar amount required for January through February. In Figure 4, we see that nearly 14,000 metric tons of ammonium nitrate were imported during November and December. For each of the years 1971-73, approximately 50 percent of the ammonium nitrate fertilizers had been imported during the four months November through February, the four months during which the Ministry of Agriculture recommends nitrogen application for wheat.

The uncertainty of fertilizer demand at the farm, retail, and wholesale levels has complicated the programming of fertilizer transport by the semi-governmental truck (Societé Regionale des Transports) and rail (Societé National de Chemin de Fer) companies. Further, transport bottlenecks easily occur with the high concentration of fertilizer shipments during a three or four month period of the year. For example, in 1972,62 percent of the fertilizer transported by rail was moved during the three month period, September-November, Figure 5.

The multi-purpose character of available fertilizer storage facilities additionally compounds the fertilizer availability problem. A Kansas State grain study found that "some centers (cereal centers) are filled with grain and must wait for outbound grain shipments before fertilizer can be ordered and made available to producers." 14/ They concluded that:

(1) Inventories (of fertilizer) were often inadequate;

(2) Lack of storage area prevents timely fertilizer distribution at the cereal centers.

In Table 13, we see that the cereals' organizations 15/ in 1972 and 1973 purchased over 90 percent of their superphosphate supplies during the months of August through November. In 1973, they purchased 36 percent in September alone.

14/ Study of the Tunisian Grain Marketing System, Report No. 47, The Food and Feed Grain Institute, Kansas State University, August 1974.

15/ Office of Cereals, Central Cooperative of Cereal Crops (CCGC), and Central Cooperative of Wheat (COCEBLE).

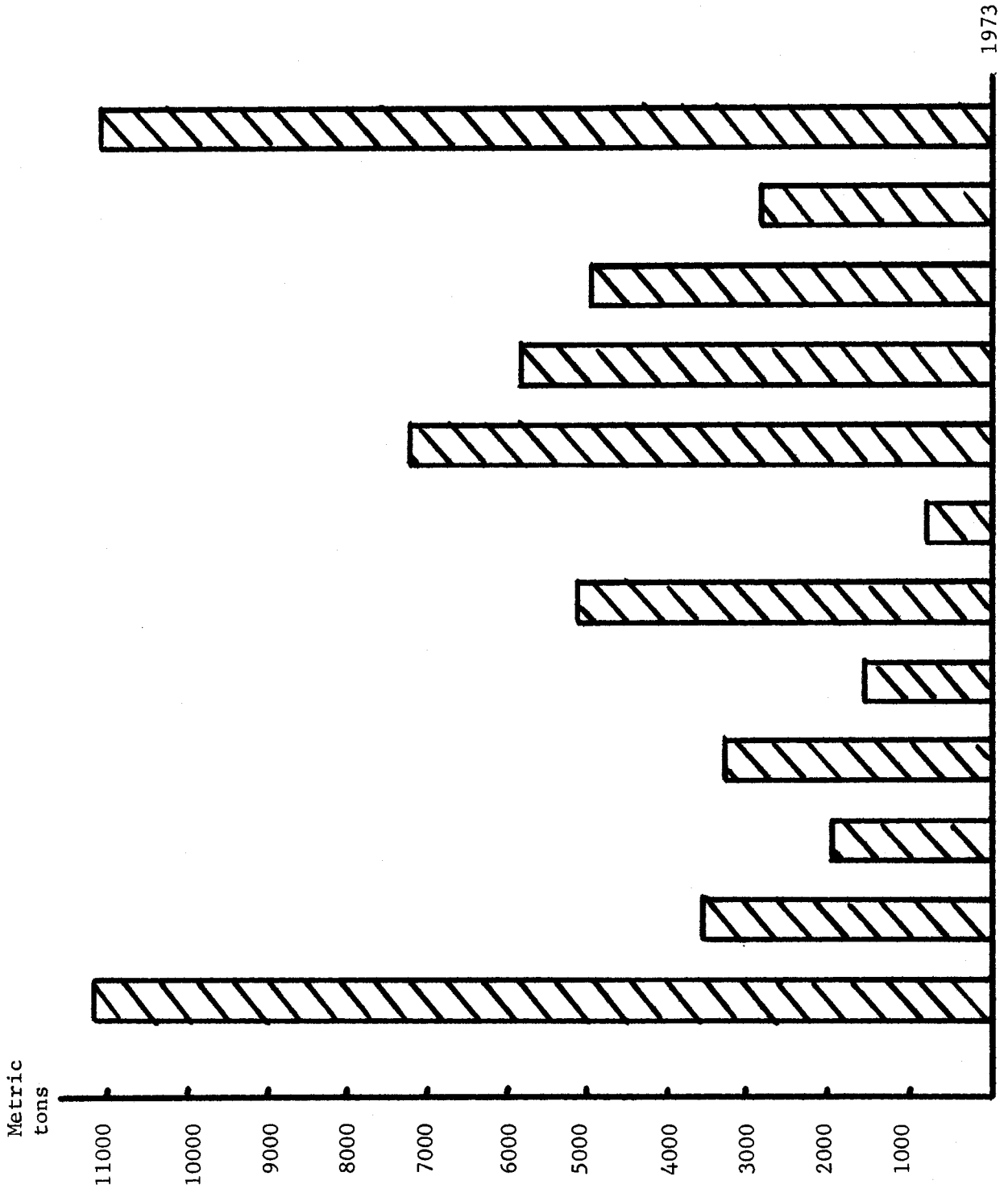


Figure 4. Ammonium Nitrate Imports by Month, 1973.

Source: Institut Nationale de la Statistique (unpublished data).

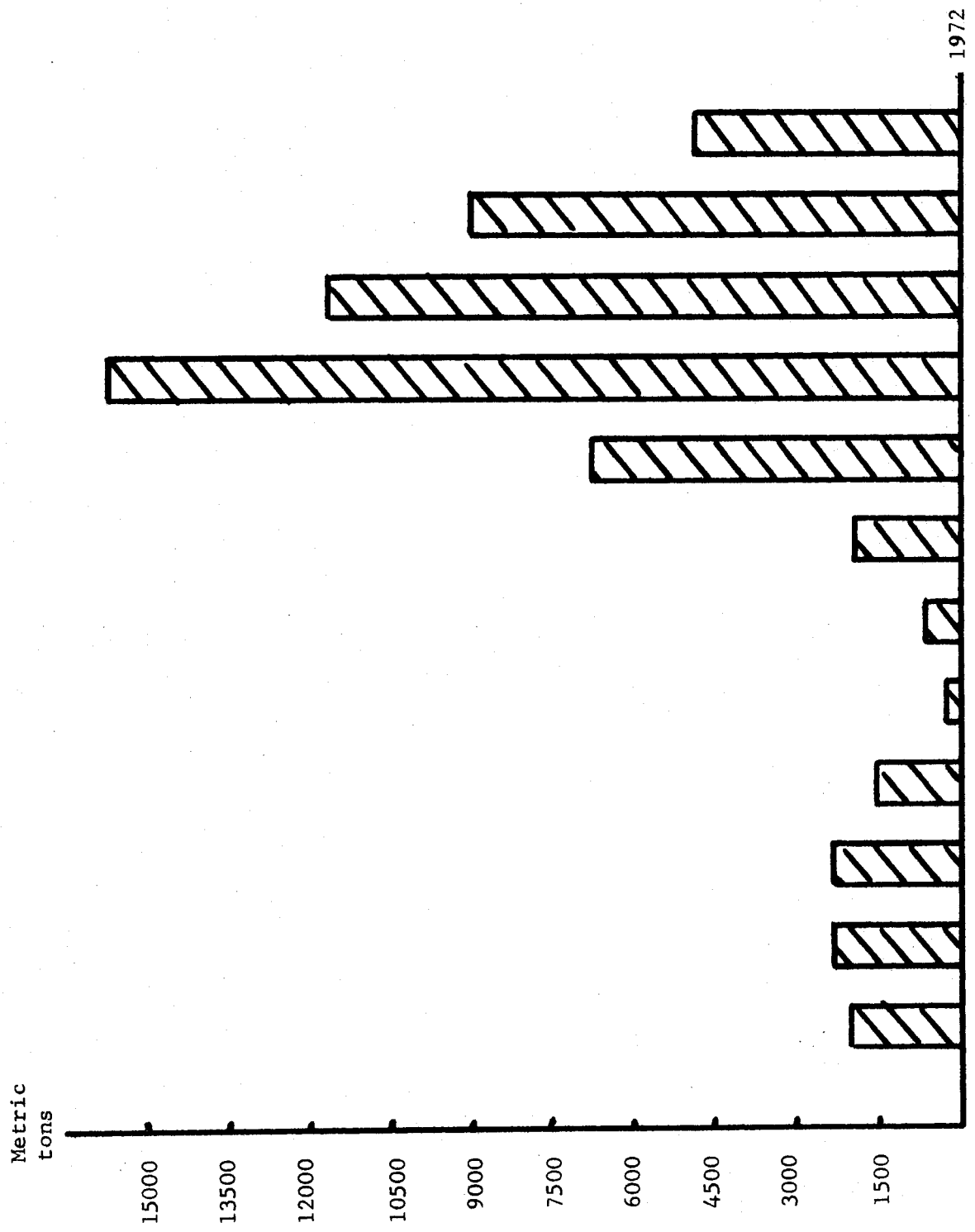


Figure 5. Monthly Shipments of Fertilizer by Rail, 1972.

Source: Societe Nationale de Chemin de Fer (unpublished data).

Table 13. Purchases of Superphosphate Fertilizers by the Cereal Organizations, 1972 and 1973.

Month	Office of Cereals				Central Cooperative of Cereal Crops				Central Cooperative of Wheat				TOTAL			
	NSP		TSP		NSP		TSP		NSP		TSP		NSP		TSP	
	1972	1973	1972	1973	1972	1973	1972	1973	1972	1973	1972	1973	1972	1973	1972	1973
	metric tons															
Jan	10	---	---	---	15	13	---	---	---	1	---	---	25	14	---	---
Feb	20	---	---	20	74	34	---	---	20	---	---	---	114	34	---	20
March	---	---	---	60	32	11	5	20	---	---	---	---	32	11	5	80
April	---	---	---	70	26	2	---	---	---	3	---	---	26	5	---	70
May	10	---	---	166	53	6	200	---	---	---	---	---	63	6	200	166
June	---	---	---	150	---	---	---	---	---	---	---	---	---	---	---	150
July	---	---	---	1290	15	---	---	---	390	---	315	---	405	---	315	1290
Aug	683	1606	100	650	263	408	---	890	256	310	802	344	1202	2324	902	1884
Sept	2046	2174	1730	1730	1132	1018	968	1477	688	406	2138	3015	3866	3598	4836	6222
Oct	2200	2103	2189	870	1876	751	2607	1001	821	351	55	370	4897	3205	4851	2241
Nov	303	1964	1940	880	1543	1100	2237	1735	132	127	90	449	1978	3191	4267	3064
Dec	450	215	190	---	516	25	18	50	7	2	---	13	973	242	208	63
TOTAL	5722	8062	6149	5886	5545	3368	6035	5173	2314	1200	3400	4191	13581	12630	15584	15250

Source: STEC.

Figure 6 reveals the relations of stocks, purchases, and sales of NSP for the Office of Cereals in 1973. The graph reveals their practice of carrying low stocks during the off-season and the rapid buildup of stocks immediately prior to the peak demand period.

While shortages can occur in the interior even as sufficient supplies are available in Tunis, the most frequent difficulty is in temporary shortages at the wholesale level. Of the 47 retail outlets interviewed for this study, 26 reported periodic shortages at the wholesale or factory level. The percentage of outlets reporting these shortages was almost identical for all retailer types: cereal centers, service cooperatives, and independent retailers.

Credit

Another limitation on expanded fertilizer use is the inability to obtain financing for fertilizer purchases. Credit is available from two types of sources: (1) merchants or agencies who sell inputs to farmers and (2) specialized credit or bonding agencies. In Tunisia, over 90 percent of the credit (as distinguished from merchant credit) is provided by the National Bank. In order for a farmer to receive credit from the bank, he must be financially sound, provide a strong guarantee of repayment, and provide proof of land ownership. This last requirement alone excludes about 90 percent or more of the farmers. Thus, most of production credit extended from this source goes to the larger, more modern farmers. The small farmers must rely on other sources of credit. It is estimated that only six percent of the farmers are reached through short-term credit programs. 16/

Independent retailers and service cooperatives who distribute fertilizers provide short-term credit. The retail level survey results indicate that 67 percent of the independent retailers and almost all of the service cooperatives offer some form of credit to farmers.

Another source of credit for small farmers is the Mutual Credit Program which had 45 independent local mutual credit unions on December 31, 1971, located in principal agricultural areas. It appears to be inadequate to meet all needs. The difference between needs and availability is illustrated by the local credit union in Pont Du Fahs, a principle wheat growing area. A survey conducted in 1973 revealed that 700 farmers applied for loans. 17/ Between 150 and 200 received loans. The survey discovered that those farmers having less than 20 hectares had never received credit. Some had never requested a loan.

16/ The Marketing and Distribution of Fertilizer in Tunisia, National Fertilizer Development Center, Tennessee Valley Authority, November 1974.

17/ Irene Hauri, La Révolution Verte en Tunisie, Institut d'Etudes de Développement Economique et Social, Tunis, mai 1973.

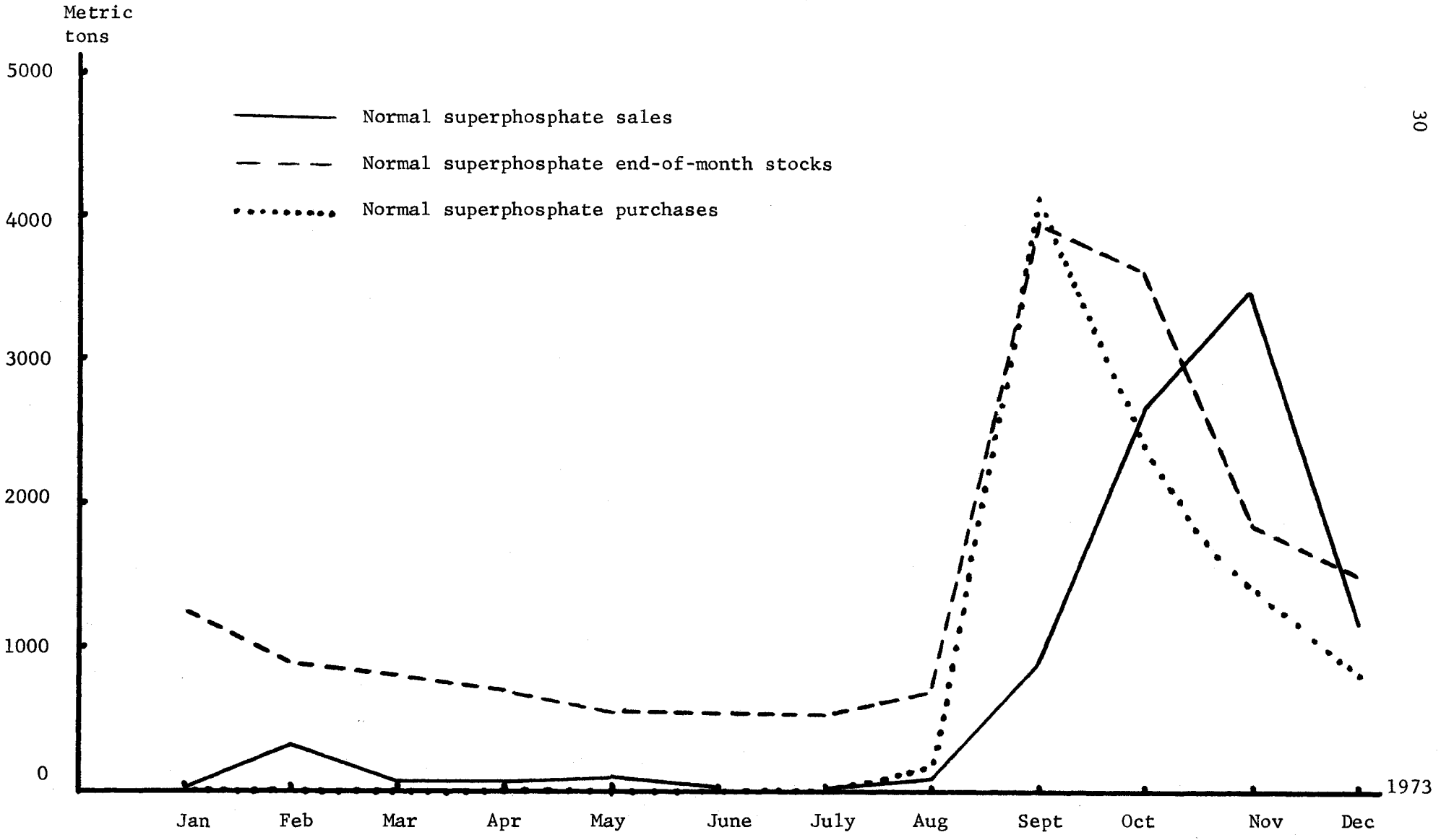


Figure 6. Monthly Purchases, Sales, and Stocks of Normal Superphosphate (Office of Cereals), 1973.

The national commodity offices and Central Cooperatives provide inputs to farmers on a credit basis. Their terms of loans vary, but in most instances, repayment takes place after the harvest period. If an interest rate is charged, it will normally cover only administrative costs. In many cases, credit is extended in a package, including seeds, fertilizer, and other chemical inputs. Credit from these organizations is available to farmers who do not have a history of bad debts. Unfortunately, the percentage of farmers having such repayment records is high.

Although short term credit is available through a variety of programs, a recent Tennessee Valley Authority (TVA) study concluded that "many of the small farmers are outside of the usual credit channels. They lack the required collateral, live in areas remote from credit organizations, and are not aware that the use of credit can expand opportunities for them." 18/

Farmer Knowledge

The adoption of a new technology by farmers is likely to depend upon several factors, among them -- the level of education; knowledge of the technique, which can be influenced by quality and extensiveness of agricultural extension service; and the degree of visibility of the advantage of adopting the new technique.

The livestock survey, mentioned earlier, found that 72 percent of the livestock farmers had no formal education. Only 4.2 percent were aware of the existence of extension agencies and services, 1.7 percent were aware of extension meetings, and 0.5 percent were aware of extension bulletins. If we generalize from livestock farmers to all farmers, we can conclude that a large percentage of the farmers are not being reached by the extension service.

In 1972, there were 361 extension agents throughout the country who work under the intervention branch of the Agricultural Extension Service; 185 of these worked directly with farmers. Thus, for the estimated 320,850 private farms in Tunisia, there was one extension agent for every 888 farmers. The ratio for agents who had actual contact with farmers was 1,734. This ratio is somewhat deceiving in that many of the Central Cooperatives and National Commodity Offices were and are involved in extension activities.

Another aspect of farmer knowledge is indicated by the use of high cost, low analysis fertilizers. Many farmers have not yet been convinced that the use of urea (45 percent N) as opposed to ammonium nitrate (33.5 percent N) and triple superphosphate (45 percent P_2O_5) as opposed to normal superphosphate (16 percent P_2O_5) may be to their cost advantage. NSP, for example, costs 0.019 TD more per unit of P_2O_5 than TSP in terms of retail price at Tunis.

18/ The Marketing and Distribution of Fertilizer in Tunisia, National Fertilizer Development Center, Tennessee Valley Authority, November 1974.

The continued use of NSP means not only higher prices to producers per unit of plant nutrient, but an inefficient use of storage and transport space as the nutrient value of one bag of TSP is equivalent to the nutrient value of 2.8 bags of NSP. Thus, the 1 to 2.8 equivalency means the farmers' use of NSP as opposed to TSP increases his transport, handling, storage, and spreading costs.

The greater profitability of TSP on a per hectare basis can be calculated for field trial data. For example, Capitaine found that application of 40 kilograms of P_2O_5 increased durum wheat production in the Mateur area by 4.45 quintals per hectare. 19/ Using 1974 wheat and fertilizer prices, the net benefit of the application was 2.33 dinars per hectare greater by using TSP rather than NSP. Due to these price and cost relationships, the farmer who uses NSP and applies the economic optimum amount will experience lower yields and apply fertilizer at a lower rate than a farmer using the economic optimum amount of TSP.

19/ Capitaine, R.C., Fertilisation dans le Cas d'un Type d'Assolement Céréalier en Tunisie, Annales de l'Institut National de la Recherche Agronomique en Tunisie, 1968.

III. PRODUCTION AND DISTRIBUTION SYSTEMS

Market Channels for Fertilizer

The production and distribution of fertilizers in Tunisia occur within a structure that includes government offices and agencies, cooperatives, independent retailers, and fertilizer manufacturers (both semipublic and private). The importation of nitrogen and potassium fertilizers and the production and wholesaling of phosphate fertilizers are in the hands of a small number of firms. However, the power of the firms involved has been limited by government ownership of share capital. The retail market, in contrast, is more competitive in terms of number. Most rural trade centers in the northern region and along the central region's coastline are serviced by two or more retail distributors of fertilizer.

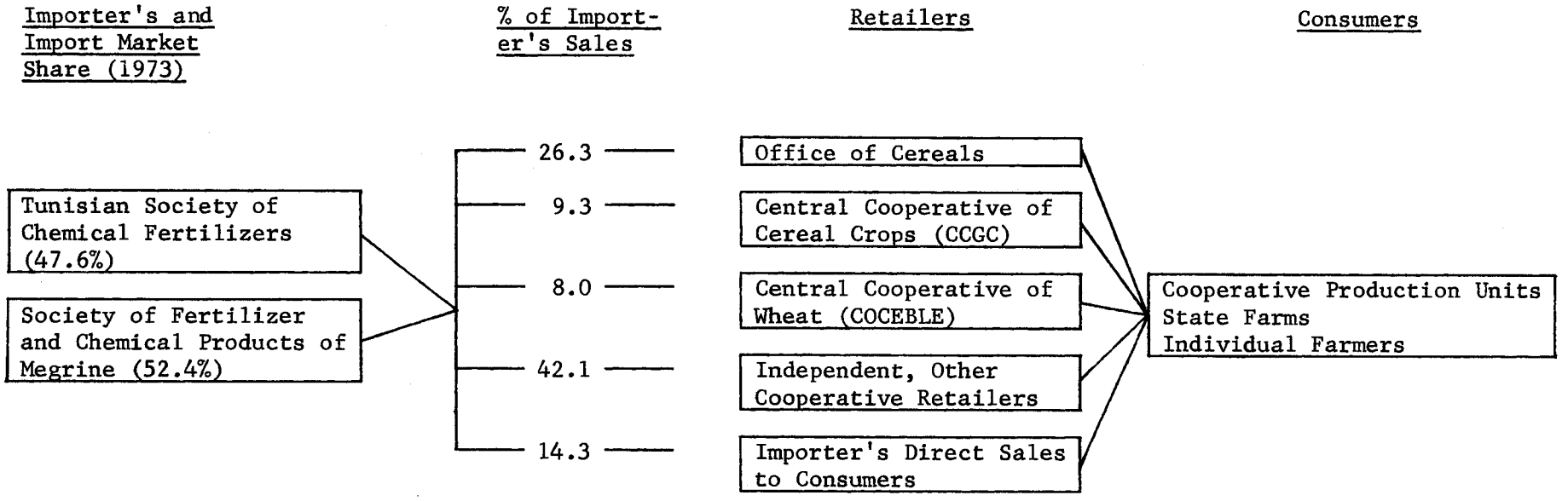
The structure of the industry and the flow of each of the major fertilizers from manufacturers or importers to farmers is illustrated in Figures 7 through 9. These indicate the major firms and agencies involved in distribution and the relative importance of the different types of firms or agencies. In 1973, there were two importer/wholesalers for ammonium nitrate. The Society of Chemical Products and Fertilizers of Megrine (SEPCM) controlled approximately 52.4 percent of the market and STEC 47.6 percent. Together their direct sales to consumers (i.e. farmers, cooperatives, state farms, etc.) were approximately 14.3 percent of their total sales. A large share of their sales were to the cereal organizations (Office of Cereals, CCGC, and COCEBLE). They accounted for 43.6 percent of their sales in 1973. Independent and cooperative retailers (other than CCGC and COCEBLE) [20/] were their most important customers, as they accounted for approximately 42.1 percent of their sales, Figure 7.

For 16 percent normal superphosphate (NSP), there is only one producer and wholesaler, STEC. It also performs a retail function. In 1973, independent retailers accounted for 34.0 percent of STEC's sales, the cereals organizations 39.9 percent, and other cooperatives 6.8 percent. Direct sales to consumers were 19.3 percent, Figure 8.

The Industrial Society of Phosphoric Acid and Fertilizer (SIAPE) in 1973 was the sole producer of 45 percent triple superphosphate (TSP) for the domestic market. STEC has exclusive rights from SIAPE to wholesale its product. In 1973, STEC sold 65.6 percent of its TSP to the cereal organizations. Independent retailers accounted for 13.9 percent of STEC's sales and cooperatives 1.5 percent. STEC's retail sales to direct consumers represented 19.0 percent of total sales, Figure 9.

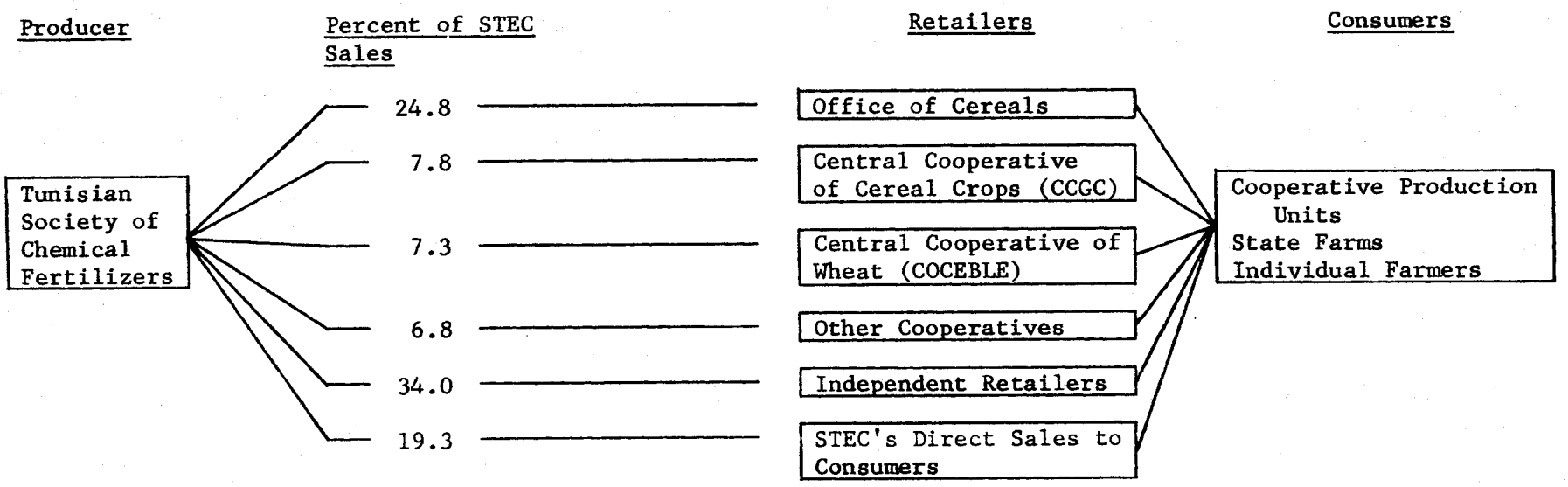
20/ Throughout this paper when the word cooperative is used, it will exclude CCGC and COCEBLE unless otherwise stated.

Figure 7. The Distribution System for Ammonium Nitrate 33.5%, 1973. 1/



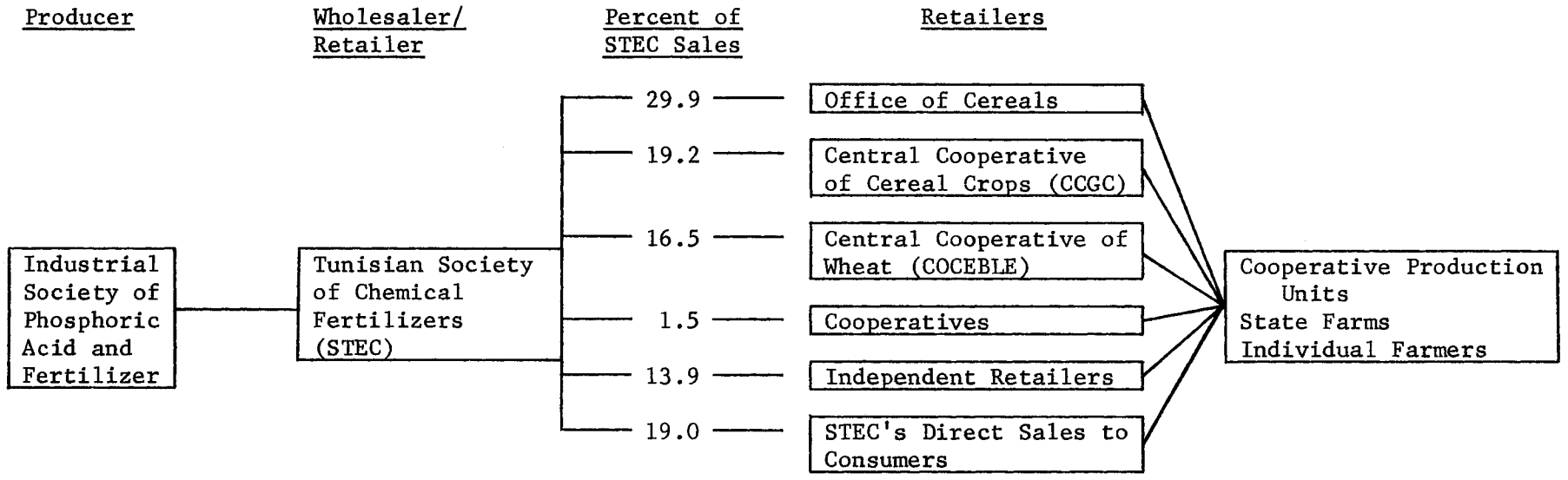
1/ The percent of sales figures are estimates.
Source: Ministry of National Economy, Tunisian Society of Chemical Fertilizers, Industrial Tunisian Society of Chemical Products and Fertilizers.

Figure 8. The Distribution System for Normal Superphosphate 15-16%, 1973.



Source: Tunisian Society of Chemical Fertilizers (STEC).

Figure 9. The Distribution System for Triple Superphosphate 45%, 1973.



Source: STEC.

Of the total fertilizer supply in 1973, measured in units of pure nutrient, approximately 46 percent was in the form of ammonium nitrate, 27 percent in the form of normal superphosphate, and 20 percent in the form of triple superphosphate. Together these three fertilizers represented over 90 percent of total supply. Potassium and mixed fertilizers account for the balance.

It is estimated that 132,281 metric tons of fertilizer were supplied to the domestic fertilizer market by manufacturers and importers in 1973. Actual retail sales were estimated to be 133,000 to 134,000 metric tons. 21/ On the basis of these data, one could state that domestic fertilizer supply approximated farm level consumption in 1973.

Fertilizer Manufacturers

Three firms produced basic fertilizer ingredients in 1973 and 1974. Annual volumes of production are listed in Table 14. Since 1961, triple superphosphate production has experienced the largest growth. The companies engaged in manufacturing are as follows:

NPK Fertilizer, S.A.T.

NPK Fertilizer is a subsidiary of a Swedish phosphate company. NPK is privately owned, with 64 percent owned by the Swedish firm.

NPK Fertilizer manufactures TSP primarily for export. Their plant, which is located in Sfax, was initially designed for an annual capacity of 150,000 metric tons. The plant began production in 1965. Since 1968, production has increased from 120,000 metric tons to an estimated 180,000 metric tons in 1974. Present capacity is 180,000 metric tons. (See Table 15 for ownership, fertilizer product, and import storage capacity of all companies supplying the domestic fertilizer market.) NPK's crude phosphate supplies are obtained from the Gafsa phosphate mining area.

Officials of NPK state that their purpose is exporting TSP and, consequently, the earning of foreign exchange for the GOT. They occasionally supply fertilizer to the domestic market, but do not consider it as their most attractive alternative. In 1970 and 1971, NPK Engrais supplied the domestic market through the Office of Cereals with 2,226 and 4,180 metric tons, respectively, or about 10 percent of domestic TSP consumption for those years. In 1972, the Office of Cereals requested the company to supply it with 10,000 metric tons. However, it was unable to deliver the quantity requested within the necessary time period.

21/ It should be pointed out that official government estimates of fertilizer sales or consumption do not include mixed fertilizers.

Table 14. Fertilizer Production in Tunisia, 1961-74.

Fertilizer Kind	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974 1/
	1,000 metric tons													
Normal Superphosphate	24.5	26.1	48.2	48.8	27.9	32.9	31.2	34.0	33.0	32.8	36.0	41.0	50.0	50.0
Triple Superphosphate	135.0	156.0	138.0	152.0	293.0	267.0	324.0	377.0	333.0	383.0	424.0	414.0	415.0	450.0
Ammonium Sulfate	--	--	--	--	--	1.3	1.6	5.4	0.4	11.0	--	--	--	--
Hyperphosphate	69.0	36.8	85.9	100.4	114.2	77.0	2.1	20.0	58.0	28.0	7.0	9.0	20.0	10.0
Mixed Fertilizers	8.4	12.1	4.8	9.4	9.5	10.0	7.1	11.2	12.8	8.0	9.4	9.2	12.0	18.0
Phosphoric Acid	--	2.1	3.9	6.8	7.7	6.7	10.1	10.8	9.0	7.0	1.0	61.7	100.0	116.0

1/ Projection.
Source: Ministry of Plan.

Table 15. Ownership, Fertilizer Production, and Import Storage Capacity of the Tunisian Fertilizer Industry, 1973. 1/

Organization	Plant Location	Ownership		Production		Importation	
		Public	Private	Product	Capacity	Product	Storage Capacity
		----- percent ----			1,000 metric tons		1,000 metric tons
SIAPE	Sfax	81	19	TSP	260.0		
NPK Fertilizer	Sfax	0	100	TSP	180.0		
STEC	Tunis	65	35	NSP	60.0	Nitrogen	10.0
	Sfax			Mixed Fertilizers	7.0		
SEPCM	Tunis	0	100	Mixed Fertilizers	7.0	Nitrogen	3.0
STIPCE	Tunis	0	100	Mixed Fertilizers	3.0	Nitrogen	1.0

1/ Includes those organizations who produce or import fertilizers used domestically. NPK Fertilizer did not supply the domestic market in 1973. Office of Cereals has imported fertilizer during some years.

Since 1971, the price of TSP on the foreign market has increased, and the difference between it and the controlled domestic price has widened. Thus, NPK Engrais has found the domestic market to be a less and less attractive alternative.

The Industrial Society of Phosphoric Acid and Fertilizer (SIAPE)

SIAPE, established in 1954, was the first plant in North Africa to process local phosphate rock into TSP. It is owned by both public and private interests. The GOT controls 81 percent of the capital through the Gafsa Phosphate Company. The plant, which is located in Sfax, had an annual capacity of 170,000 metric tons when first established. The capacity has been increased to 260,000 metric tons.

SIAPE's source of crude phosphate is the Gafsa mining area. It produced 255,000 metric tons of TSP in 1973, selling 28,007 metric tons domestically with 25,774 metric tons used by agriculture. 22/ Tunisian triple superphosphate production, exports, domestic sales, and inventories for the period 1971-73 are listed in Table 16.

During the last three years, about 10 percent of SIAPE's annual production has been diverted into the domestic market. The proportion of production that is sold in the domestic market is bagged in 50 kilogram bags by GRANUPHOS in their plant at Sfax. (GRANUPHOS is a new fertilizer company which has taken over what was formerly STEC's bagging operation.)

The Tunisian Society of Chemical Fertilizer (STEC)

STEC was created in 1967 when two fertilizer companies, SAPCE (founded 1902) and STEP (founded 1936), merged. Its share capital is divided among three groups; the GOT indirectly controls 65 percent through the Office of Cereals and Sfax-Gafsa own 34 and 31 percent, respectively. (Sfax-Gafsa is a phosphate mining company.) The balance of the share capital is owned by a Paris holding company. STEC has a monopoly in the production and sale of NSP. Their plant is situated outside of Tunis in the suburb Djebel Jelloud. The factory, constructed well before independence (1956) is antiquated. The annual capacity of the plant is reported to be 60,000 metric tons. Production in 1973 was 49,602 metric tons, up from 41,000 metric tons in 1972, Table 14.

22/ SIAPE sells TSP for industrial use, domestically, and to the manufacturers of mixed fertilizers.

Table 16. Tunisian Triple Superphosphate Production, Exports, and Inventories by Company, 1971-73.

	1971	1972	1973
	---- 1,000 metric tons ----		
Production			
SIAPE	262.0	245.0	255.0
NPK Fertilizer	162.0	169.0	160.0
Total	424.0	414.0	415.0
Domestic Consumption			
SIAPE	35.2 1/	26.6	28.0 2/
NPK Fertilizer	4.0	--	--
Total	39.2	26.6	28.0
Year-End Inventories			
SIAPE	+ 7.6	- 1.8	+ 0.5
NPK Fertilizer	- 0.4	- 5.2	--
Total	+ 7.2	- 7.0	+ 0.5
Exportation			
SIAPE	278.0	245.6	267.0
NPK Fertilizer	99.6	148.8	117.5
Total	377.6	394.4	384.5

1/ SIAPE reports domestic sales of 24.219 metric tons.
2/ Source: SIAPE.
Source: Ministry of Plan.

STEC's crude phosphate supplies arrive by rail from the mining region of Thala in the west central part of the country. STEC is the only phosphate fertilizer company that depends upon and uses crude phosphate from this area. The sulfuric acid used for phosphate fertilizer production has been purchased from SIAPE since 1972.

In addition to NSP, STEC produced 4,500 metric tons of mixed fertilizers in 1973, a decrease of seven percent over that of 1972. Mixed fertilizer production by company is listed for the period 1971-73 in Table 17. STEC's production capacity is reported to be 7,000 metric tons. According to the Ministry of Plan, STEC in 1973 produced 37.5 percent of the mixed fertilizers in Tunisia.

Society of Chemical Products and Fertilizers of Megrine (SEPCM)

SEPCM is a private company affiliated with the French company Potasse d'Alsace. SEPCM's activities consist of the importing of fertilizers, the production of mixed fertilizers, and the sale of

fertilizers and other chemical, agricultural inputs. It is located at Megrine near Tunis, but away from port and rail facilities. In 1973, it accounted for 40 percent of Tunisia's mixed fertilizer production and approximately 50 percent of all fertilizer imports. SEPCM's share of the production of mixed fertilizers has increased since 1971 relative to STEC, Table 17. Its annual production capacity is 7,000 metric tons.

Table 17. Mixed Fertilizer Production in Tunisia, 1971-73.

Company	1971		1972		1973	
	1,000 metric tons	percent	1,000 metric tons	percent	1,000 metric tons	percent
STEC	5.5	58.5	4.1	44.6	4.5	37.5
SEPCM	3.0	31.9	4.0	43.5	4.8	40.0
STIPCE	0.9	9.6	1.1	12.0	2.7	22.5
TOTAL	9.4		9.2		12.0	

Source: Ministry of Plan.

Industrial Tunisian Society of Chemical Products and Fertilizers (STIPCE)

STIPCE is a private company. It is engaged in importing of fertilizers, mixing fertilizers, and the sale of fertilizers and other chemical, agricultural inputs. Its plant is located in the Megrine near that of SEPCM. STIPCE imported little, if any, fertilizer in 1973. It purchased its nitrogen and potassium needs for mixed fertilizer production from SEPCM and STEC. Its share in the production of mixed fertilizers increased from 9.6 percent in 1971 to 22.5 percent in 1973. Its present annual capacity is 4,000 metric tons.

Import and Export Activities

Imports

Three companies import the bulk of the chemical fertilizers: SEPCM, STEC, and STIPCE. The Office of Cereals imports fertilizer gifts (or those quantities of fertilizers sent under special credit arrangements) to the GOT and during shortage periods. Small imports by other private companies, such as LaFarge, take place but are minimal in comparison. LaFarge, the fifth largest importer, imported 200 metric tons of 12-12-17 in 1973.

In 1973, ammonium nitrate represented approximately 95 percent of all nitrogen fertilizers imported, with ammonium sulfate, ammonium nitrate-lime, and urea accounting for the balance. Two kinds of potassium fertilizers were imported. Potassium sulfate represented 97 percent and muriate of potash three percent. Total imports for 1961-73 are listed in Table 18.

Table 18. Tunisian Fertilizer Imports, 1961-73.

Year	Nitrogen Fertilizers	Potassium Fertilizers	Other Fertilizers	TOTAL
	1,000 metric tons			
1961	12.8	2.5	1.5	16.8
1962	13.5	4.5	2.0	20.0
1963	26.3	5.1	3.1	34.5
1964	25.0	6.5	2.2	33.7
1965	16.5	1.8	0.1	18.4
1966	20.1	3.5	<0.1	23.7
1967	21.5	3.5	4.3	29.3
1968	28.4	3.4	0.1	31.8
1969	42.5	6.8	<0.1	49.4
1970	41.6	4.4	0.5	46.6
1971	74.5	6.4	1.8	82.7
1972	37.4	0.5	0.4	38.3
1973	56.9	7.3	0.3	64.5

Source: Statistiques du Commerce Exterieur, Institut Nationale de la Statistiques, Republique Tunisienne (Annual Reports).

In 1973, fertilizer import quotas were established for STEC, SEPCM, STIPCE, and the Office of Cereals. A Fertilizer Importer's Syndicate 23/ proposes an import quota breakdown in the Ministry of National Economy on the basis of total needs and historical market shares. The Ministry then incorporates the syndicate's estimates and an Office of Cereals' estimate 24/ into a quota scheme which covers the needs estimates as calculated by the Ministry of Agriculture. Import licenses are issued annually for each importer's quota. The countries of origin are designated. The Commercial Division of the Ministry of National Economy is in charge of overseeing the licensing and of regulating the importation of fertilizers.

23/ Composed of major fertilizer importing companies.

24/ The reason for granting the Office of Cereals a quota is not clear, as the quantity of their imports depends upon the tightness of the domestic market and the occasional donation of fertilizer gifts to the GOT.

STEC and SEPCM account for the largest quota share of nitrogen fertilizer, which is equally distributed between them. SEPCM is the major importer of potassium fertilizer.

Increased dependency on nitrogen fertilizer imports has posed considerable strain on import distribution services. Storage facilities and conditions have not changed significantly since 1967 when 29,290 metric tons of nitrogen, potassium, and other fertilizers were imported. In 1973, import storage capacity for the three companies involved in importing nitrogen and potassium was 14,000 metric tons. Imports in 1973 totaled 64,487 metric tons, an increase of 221 percent over that of 1967.

Nitrogen fertilizers represent the bulk of total fertilizer imports, 88.2 percent in 1973 (Table 18). Imports of this nutrient have increased dramatically since 1961, but with considerable year-to-year variation.

Potassium fertilizers accounted for 11.3 percent of 1973 fertilizer imports. Sulfate of potash is the most popular of the potassium fertilizers. The level of imports has increased since 1961, but not at a steady rate.

STEC imports fertilizer through the port of Sfax. It has no facilities at the port of Tunis. All fertilizer imported by Tunis (La Goulette) much be transshipped by truck, which STEC claims is more expensive than transshipment by rail from Sfax. STEC has imported nitrogen fertilizers, principally from Greece and Bulgaria, and potassium fertilizers from France. In 1973, STEC imported 28,302 metric tons of ammonium nitrate, 737.5 metric tons of ammonium sulfate 20.5 percent, and 2,925.4 metric tons of sulfate of potash 51 percent. Their storage capacity for imports is 10,000 metric tons.

SEPCM imports its fertilizer through the port at Tunis. It imports principally from France where it has contracts or affiliations with four companies. In 1973, it imported approximately 30,000 metric tons of ammonium nitrate and 4,000 metric tons of potassium fertilizers. Its storage capacity for imports is 3,000 metric tons.

STIPCE also imports fertilizer by the port at Tunis. It has purchased its imports, primarily from an Italian company. Its storage capacity is estimated to be 1,000 metric tons for fertilizer imports.

The Office of Cereals' imports of fertilizer vary substantially from year to year. During the period September 15 through October 29, 1971, it imported 24,722 metric tons of ammonium nitrate. It was stored unprotected in the open and approximately 14,000 metric tons were lost due to rain. After this calamity, the Office of Cereals was informed that it would no longer be allowed to import fertilizer. However, in 1972, it did import a small quantity (6,285 metric tons) of lower concentrated forms of nitrogen fertilizers. In July of 1972, the government allowed the Office of Cereals a quota, due to its importance in the

domestic distribution of fertilizer to cereal farmers. It imported no fertilizer in 1973. In early 1974, as a shortage of ammonium nitrate developed, it imported 5,000 metric tons.

Historically, the Office of Cereals has imported prior to or during peak demand periods, i.e., September-October and January-February. Lacking storage facilities, it has carried out this practice so as to minimize storage needs. This pattern of import timing is also a result of the GOT's policy of relying on the Office of Cereals to cover wheat growers' fertilizer needs during shortage periods. Under normal market conditions, the Office of Cereals fulfills its fertilizer needs through purchases from SEPCM, STEC, and STIPCE.

Exports

The phosphate industry in Tunisia is export oriented. In 1972, phosphate fertilizer exports accounted for 28.8 percent of the GOT's total foreign exchange earnings, Table 19. SIAPE and NPK fertilizer in 1972 produced 414,000 metric tons 25/ of TSP. Of this total, 95.3 percent or 394,400 metric tons were exported. Italy and France typically account for approximately one-third of total exports, Table 20.

Table 19. The Importance of the Phosphate Industry's Exports in Relation to the Tunisian Balance of Payments, 1968, 1970, and 1972.

	1968	1970	1972
	------ 100,000 dinars ------		
Phosphate Exports			
Hyperphosphates	0.3	0.2	0.2
Natural Phosphates	14.0	16.9	19.4
TSP	10.1	11.5	12.5
Total	24.4	28.6	32.1
Tunisian Balance of Payments			
Value of Total Exports	78.6	98.0	111.5
Value of Total Imports	120.0	153.0	161.0
Balance	- 45.6	- 59.0	- 52.5

Source: Plan de Développement Economique et Social, Secrétariat D'Etat au Plan et à l'Economie Nationale, 1969-72.

Tunisia has a favorable competitive position in the European phosphate market for two reasons: (1) geographically, the location of Tunisia is attractive for exports to Europe in terms of freight costs and (2) as an associate member of the European Economic Community (EEC),

25/ SIAPE had an inventory of 7,600 metric tons at the end of 1971.

it has no problem with import duties. In 1970, the GOT signed a preferential trade agreement with the EEC, which has a five year duration. For other markets, the opening of the Suez Canal could have favorable effects. In 1972 and 1973, Tunisia exported TSP to Indonesia, Burma, Pakistan, and China (1973). In 1972, 12 percent of their exports went to Asia and in 1973 (January-August), 14 percent.

Table 20. Principal Importers of Tunisian Triple Superphosphate, 1971, 1972, 1973 (January-August).

	1971	1972	1973 (Jan.-Aug.)
	-------- 1,000 metric tons --------		
Algeria	36.3	14.1	--
Brazil	2.0	29.6	35.3
Bulgaria	101.4	40.0	15.4
Burma	--	21.8	7.5
China	--	--	13.3
UE Belgo-Luxembourg	26.9	35.1	4.2
USSR	--	10.4	3.0
Italy	60.3	61.2	39.5
France	79.1	85.4	26.7
Hungary	--	5.4	16.3
Sweden	22.9	28.3	4.4
Netherlands	12.0	18.7	39.2
Spain	12.8	9.0	5.6
Yugoslavia	16.0	--	--
Others	45.6	47.7	32.8
Total	415.3	406.6	243.0

Source: Statistiques du Commerce Exterieur, Institut Nationale de la Statistiques, Republique Tunisienne (Annual Reports).

The favorable world prices for TSP in 1973 and 1974 created domestic supply problems. Domestic producers of phosphate were reluctant to supply the domestic market at lower internal prices and the early signing of export contracts in November and December for 1974, before the domestic needs were firmly established by the Ministry of Agriculture, led to a tight domestic market for TSP. In 1973, less than seven percent of the TSP production was diverted to domestic use.

Prices, Taxes, and Subsidies on Importers and Manufacturers

Ammonium Nitrate

In 1970, the GOT set the controlled price of ammonium nitrate at 30.000 TD per metric ton. This was less than the existing domestic price. As the controlled price was below world prices and the importer's costs, the government was forced to pay a subsidy (about 7.000 TD per metric ton) in 1973. 26/ The subsidy was then based on purchase price and distribution costs. Under the subsidy program in 1973, the importers were allowed a profit margin of 0.825 TD, or approximately three percent of the CIF value per metric ton. At the conclusion of the in-country portion of this study, the Ministry of National Economy was endeavoring to increase the margin to five percent.

An increase in the importer's costs or the world price will require an increase in subsidy payments. In 1973, the importer's per metric ton cost of ammonium nitrate (CIF value plus overhead and operating costs) was approximately 37.000 TD. In early 1974, the cost rose to 65.500 TD and the GOT predicted that by fall of that year, the costs would increase to 90.000 TD. Faced with a subsidy payment of 60.000 TD per metric ton, the GOT then decided to increase the controlled price to 50.000 TD.

The revenue generated by the production tax on nitrogen imports of eight percent was then considerably less than the GOT's subsidy payment. In 1973, the revenue generated by the tax was less than 3.000 TD per metric ton, as opposed to the subsidy payment of 7.000 TD. The abolishment of the production tax could have lowered the required subsidy payment without a reduction in net cost to the government, as the tax was merely handed back to the suppliers as a part of the subsidy.

Two characteristics of the application of the subsidy payment scheme for ammonium nitrate have tended to reduce its effectiveness in expanding imports and use. First, the subsidy payments to importers are not paid until the importer sells the fertilizer. Even then, tardiness in payment is not uncommon. Second, there is uncertainty as to the amount of the subsidy and the costs that will be accepted in calculating the subsidy. Under these circumstances, importers are not likely to import more than they can be assured of selling at the controlled price.

Normal Superphosphate (NSP)

Price fixing for NSP began in 1970, being fixed at the prevailing market price of 15.900 TD per metric ton. Consequently, the prevailing margin for STEC, the only NSP manufacturer in the country, was unaffected.

26/ Using the estimated average per metric ton cost of importing fertilizer for 1973.

The controlled price prevailed through 1970-April 1973, but STEC's costs of production increased. Costs increased for labor, crude phosphates, sulfuric acid, transport, and plastic bags. Over the period 1968-1974, the total costs more than doubled, increasing from 13.600 TD to 28.325 TD. 27/ Thus, profits disappeared as costs increased.

In 1973, STEC's costs rose to a point where a subsidy was necessary to cover all costs. The subsidy payment is considerably greater than the revenue generated by the 17 percent production tax. In February 1974, the costs of producing NSP were reportedly 27.500 TD per metric ton. 28/ The tax revenue generated by the production of one metric ton of NSP was then approximately 4.000 TD, or 7.600 TD less than the subsidy payment. A continued increase in STEC's costs of production will require increased subsidy payments at the present controlled price or STEC will incur financial losses.

Triple Superphosphate (TSP)

The production of TSP is not subsidized by the GOT; however, its price is controlled at 36.000 TD per metric ton. The controlled price has not increased since 1970, while the costs of production have increased to approximately 50.000 TD per metric ton. Production costs have increased for reasons similar to that for NSP.

While the domestic price has been held constant, the world market price increased from 29.000 TD at the end of 1972 to 48.000 TD in 1973, and to 120.000 TD in March 1974. In March 1974, the world price was approximately 85.500 TD greater than the domestic wholesale price. Obviously, the export market is much more attractive to the TSP manufacturers than the domestic market.

The differences between the costs of production and the controlled domestic price are possibly absorbed by SIAPE, the one firm which provided the domestic market in 1973, through the profits realized from export sales. This type of arrangement is possible as the GOT indirectly owns 82 percent of the firm's share capital.

Wholesaling and Retailing

Cooperatives, government offices and agencies, independent retailers, and fertilizer manufacturers are involved in the distribution of fertilizers in Tunisia. Not all of the government offices and agencies provide a retail function. Several provide services only, such as placing orders with the wholesalers, providing credit, and, in some cases, actual delivery of fertilizer.

27/ Ministry of Agriculture; STEC.
28/ Ministry of Agriculture.

The Wholesale Market

The wholesale market is primarily controlled by the few fertilizer manufacturers and importers. The three fertilizer manufacturers control over 99 percent of the wholesale market and approximately 21 percent of the retail market. STEC is the principle wholesaler in Tunisia. In 1973, it sold 92,697 metric tons of fertilizer for use in the agricultural sector. STEC's fertilizer sales, by kind, for the period 1969-73 are listed in Table 21. Approximately 78.6 percent of these sales were sold wholesale. STEC maintains distribution outlets in Tunis (Djebel Jelloud) and Sfax. At these outlets, it sells both fertilizers and other chemical, agricultural inputs. Fertilizer is its principle sales item. In 1973, 20-25 percent of STEC's total sales were transacted through the Sfax outlet. These sales were primarily of imported fertilizers and TSP. Most of these sales were shipped to the north central wheat growing areas.

Table 21. STEC's Fertilizer Sales by Kind, 1969-1973.

Fertilizer Kind	1969	1970	1971	1972	1973
	--------- 1,000 metric tons --------				
Ammonium Nitrate	10.9	19.5	26.1	10.5	29.1
NSP	30.0	31.9	30.0	38.2	35.2
TSP	4.2	6.2	6.1	25.1	24.4
Potassium Sulfate	0.4	0.7	0.9	1.4	1.1
Muriate of Potash	0.4	0.6	0.4	0.1	--
Ammonium Sulfate	0.1	0.1	0.3	0.4	0.4
Limestone	0.2	0.1	0.2	0.2	0.2
Urea	--	0.2	--	--	--
Mixtures	3.3	6.2	5.3	4.3	4.2
Total	49.4	65.7	69.2	80.4	94.6 1/

1/ STEC's sales to customers other than SEPCM and STIPCE as reported in year-end totals are 92.7 metric tons.

Source: STEC.

Since 1969, STEC's total fertilizer sales have increased 91.5 percent. Increased TSP sales account for about half of the increase. The TSP sales increase is due primarily to SIAPE's decision in 1972 to grant STEC the exclusive right to wholesale its product on the domestic market. The balance of the increased sales is ammonium nitrate and NSP. NSP, TSP, and ammonium nitrate in 1973 represented 93.8 percent of the total fertilizer sales.

STEC markets fertilizer throughout the entire country. A breakdown of its sales by customers or type of customer is listed below:

Independent retailers	31.0 percent
Office of Cereals	25.0 "

Farmers and miscellaneous final customers	21.3 percent
Central Cooperative of Cereal Crops	10.6 "
Central Cooperative of Wheat	6.0 "
Other cooperative retailers	6.1 "
	100.0 percent

SEPCM and STIPCE, in addition to fertilizer production, are engaged in wholesaling and retailing. In 1973, they sold approximately 40,000 metric tons of fertilizer. Their shares of the wholesale retail market were 28.0 and 2.0 percent, respectively. Their retail sales outlets are located at their plants on the outskirts of Tunis. Both companies sell fertilizer and other chemical agricultural inputs. Chemical input sales, other than fertilizer, accounted for 60 percent of the total sales of STIPCE in 1973.

Neither SEPCM or STIPCE are located on rail lines; thus, their customers are obliged to use the more expensive truck transport system. This limits the market area for these two wholesalers mainly to the gouvernorats of Bizerte, Nebeul, and Tunis.

Operating Practices of Wholesalers

The only physical distribution function performed by the three wholesalers is storage. No deliveries are made to consumers, although SIAPE does pay for rail transport of TSP to retailers. The companies have been frequently criticized by the GOT for not carrying adequate inventories prior to peak demand periods.

The credit programs of the three wholesalers are similar. Seasonal orders can be placed prior to fertilization periods and customers can pick up partial or entire orders as needed. Customers have a 60-90 day period to pay for their purchases. If the repayment period of a customer exceeds this, then interest is charged at the national bank rate.

The merchandising function is minimal. The companies do provide technical assistance to farmers as to kinds of fertilizer to use and application rates. All fertilizer is sold in 50 kilogram bags.

Only limited competition exists in the fertilizer wholesale markets. Rebates and off-season discounts have been used by at least one major wholesaler. After the price control program was established in 1970, rebates on nitrogen and phosphate fertilizers were discontinued. At least one wholesaler in January of 1972 used a rebate (0.100 TD per quintal) in the sale of mixed fertilizers to maintain a favorable price position with that of its competitors.

An out-of-season discount price was offered by STEC in 1972 in an effort to alter the seasonality of its sales. Farmers and retailers did

not take advantage of it. While the offering of out-of-season prices appears to have little competitive value, the government has discussed the need for spreading out fertilizer purchasing and movements to ease the burden on the distribution system. STEC's experience raises a question on how it should be done or what level of discount is needed.

Because of government price fixing for phosphates and nitrogen, price competition has been eliminated at the wholesale level. Annually, the commodity offices and organizations solicit offers of supplies from the wholesalers. Since the offer price of wholesalers cannot fall below the legal wholesale price, the nature of the competition appears to be based on the ability of any one particular wholesaler to supply the desired quantity at the desired time.

The Retail Market

There are approximately 280 fertilizer retail outlets in Tunisia. Four are the retail outlets of STEC, SEPCM, and STIPCE, the fertilizer wholesalers. The remaining 276 are outlets of the cereal organizations, cooperatives, and independent retailers. The retail outlets are located primarily in the north (233) and in the garden spot areas of the central and southern regions. The Office of Cereals, CCGC, and COCEBLE (cereal organizations) dominate the market in the gouvernorats of Beja, Bizerte, Jendouba, Le Kef, and Tunis Sud, the principal cereal producing areas. Independent and cooperative retail outlets are dominant in the gouvernorats of Nebeul, Tunis, and in Bizerte, particularly eastern Bizerte. These seven gouvernorats accounted for over 95 percent of fertilizer retail sales in 1973. The following describes the operation of the various types of agencies involved in retail distribution of fertilizers.

Government Offices and Agencies

The Office of Cereals' main activities are directed toward the wheat sector. They consist of raising the level of production, purchasing, selling, exporting, and importing of wheat. It is also involved in other diverse activities, such as providing seed potatoes to farmers and the production and sale of livestock feeds. In 1973, it operated 133 centers located in rural trading centers throughout the country. These centers distributed agricultural inputs and offered technical advice to cereal farmers.

All of the 133 centers are potential fertilizer distribution points; however, fertilizer was only distributed at 84 centers in 1973. Many of the centers are located in areas where cereal production is of minor importance. The heaviest concentration of centers selling fertilizer was in the gouvernorats of Beja (13) and Le Kef (16). Office of Cereals' centers are the principle distributors of fertilizer in the gouvernorats of Beja, Le Kef, Sousse, Gafsa, Kasserine, and Kairouan. In each of these

gouvernorats, their market share exceeds 50 percent. In Gafsa, Kasserine, and Kairouan, they are the sole distributor of fertilizers, Table 22.

The Office of Cereals sold 34,130.3 metric tons of fertilizer in 1973. Its sales represented 25.4 percent of all retail sales in Tunisia.

It is estimated on the basis of the survey results that 42,420 farmers purchased fertilizer from the Office of Cereals' centers in 1973. The majority of these farmers operated farms of 25-50 hectares. In 1973, 79.3 percent of their purchases were applied on cereal crops (74.6 percent on wheat), 16.1 percent on garden crops, and 4.6 percent on tree crops.

Though the Office of Cereals sells fertilizers principally to cereal farmers, it supplies other types of farmers. In 1973, it reached an agreement with the Office of Development of the Medjerda Valley (OMVVM) to supply its members. In the same year, the Office of Oils (ONH), recognizing the operating and locational advantages of the Office of Cereals centers, asked and received permission to use the Office of Cereals centers to obtain fertilizer for its olive growers. The Office of Cereals also sells to cooperative production units and private farmers other than those mentioned above.

The centers have limited fertilizer storage capacity and facilities. Of the 18 centers sampled in the retail survey, 11 had storage difficulties. Fertilizer is frequently stored outside and must be moved from other centers as shortages develop.

Office of Cereals' centers are located at or near rail lines. In 1973, they received approximately 70 percent of their shipments by rail. The Office of Cereals possesses a truck depot in Tunis; however, few, if any, of its centers have a truck at their permanent disposal.

The centers do not deliver fertilizer to farmers. Approximately 74 percent of its customers in 1973 transported their purchases by truck or tractor and wagon; the balance used animal traction. The average service area for each center is a radius of 28.6 kilometers.

Fertilizer distribution of the Office of Cereals is on a nonprofit basis. Quantity and off-season purchase discounts are not offered. Credit is provided to cereal farmers only. The quantity of fertilizer that a farmer is permitted to purchase is based upon the number of hectares he has sown to cereals. The payment policy is 25 percent cash at purchase, with the balance paid immediately after harvest in cash or kind. A three percent annual interest rate is applied to the balance.

The function of the Office of Development of the Medjerda Valley (OMVVM) in fertilizer distribution is not limited to placing orders for farmers under its direction. Until the 1972-73 crop season, OMVVM distributed fertilizer. This distribution proved to be costly and in 1973-74, OMVVM requested the Office of Cereals to allow OMVVM's members to purchase

Table 22. Market Share Estimates of Fertilizer Retail Sales, by Retailer Types and in Gouvernorats, 1973. 1/

Gouvernorat	Cereal Agencies								Other Retailers						TOTAL	
	Office of Cereals		CCGC		COCEBLE		Total		Independents		Cooperatives 2/		Total			
	% of sales	# of outlets	% of sales	# of outlets	% of sales	# of outlets	% of sales	# of outlets	% of sales	# of outlets	% of sales	# of outlets	% of sales	# of outlets	% of sales	# of outlets
Beja	57.4	13	16.4	3	16.4	3	90.2	19	9.8	6	0.0	0	9.8	6	17.9	25
Bizerte	31.7	5	24.7	2	9.7	1	66.1	8	25.7	35	8.2	9	33.9	44	14.3	52
Gabes	48.3	4	0.0	0	0.0	0	48.3	4	49.5	6	2.2	2	51.7	8	1.8	12
Gafsa	100.0	6	0.0	0	0.0	0	100.0	6	6.0	0	0.0	0	0.0	0	0.1	6
Jendouba	48.8	9	13.3	1	30.1	2	92.2	12	7.8	2	7.8	0	0.0	2	6.6	14
Kairouan	100.0	7	0.0	0	0.0	0	100.0	7	0.0	0	0.0	0	0.0	0	0.4	7
Kasserine	100.0	5	0.0	0	0.0	0	100.0	5	0.0	0	0.0	0	0.0	0	0.4	5
Le Kef	70.2	16	8.7	2	19.4	3	98.3	21	1.7	1	0.0	0	1.7	1	12.5	22
Medenine	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	100.0	1	negligible	1
Nebeul	7.4	7	2.1	1	0.0	0	9.5	8	69.9	53	20.6	16	90.5	69	15.6	77
Sfax	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	100.0	1	100.0	1	0.3	1
Sousse	62.5	6	0.0	0	0.0	0	62.5	6	29.1	3	8.4	5	37.5	8	2.0	14
Tunis	14.1	1	18.2	1	0.0	0	32.3	2	64.3	18	2.9	5	67.2	23	18.3	25
Tunis Sud	33.1	5	19.6	1	36.3	2	89.0	8	7.4	3	3.6	4	11.0	7	9.8	15
TOTAL		84		11		11		106		127		43		170		276

Source: Office of Cereals, CCGC, COCEBLE, STEC.

1/ These estimates are based on approximately 70 percent of the fertilizer sales in 1973. The 30 percent not accounted for are those sales of SEPCM and STIPCE to customers other than the Cereal Organizations. The estimates are fairly accurate for all gouvernorats with the exception of those immediately surrounding Tunis.

2/ Excludes CCGC and COCEBLE.

fertilizer at their centers. OMVVM's present practice is to place its order with the Office of Cereals in July for the winter season beginning in September and in January for the summer season beginning in March.

OMVVM's members who own less than six hectares of land are eligible for credit from OMVVM to purchase fertilizer. The farmers pick up order forms from OMVVM after they have made a 10 percent down payment. The order forms are presented at the Office of Cereals' centers to qualify their purchases. Repayment of the credit takes place in either May or December, depending upon the season for which the fertilizer was purchased.

The Office of Oils (ONH) is in control of essentially all olive oil sales in the domestic (wholesale) and foreign markets. It also imports oil and oilseeds and blends imported oils with domestically produced olive oil for domestic sales.

In 1972, ONH, along with FAO and SIDA, 29/ organized a nitrogen fertilizer program to expand olive production. The goal of this program was to bring about the regular fertilization of 5,000,000 olive trees in Tunisia within five years. Under optimal rainfall conditions, this program will require in its fifth year 15,000 metric tons of ammonium nitrate 33.5 percent (three kg/tree). In 1972-73, the program utilized between 5,000-5,500 metric tons. For the 1973-74 period, their needs were estimated to be 12,000 metric tons. By March of 1974, they had purchased 3,736 metric tons from STEC. They had placed an order of 10,000 metric tons with STEC but, due to domestic fertilizer shortages, STEC was unable to comply. During the period 1972-73, the ONH fertilizer policy was to place an order with STEC and then let farmers pick up their own supplies. In 1973-74, the ONH requested the Office of Cereals to aid them in their distribution in the same manner as for OMVVM.

The ONH has its own fertilizer subsidy scheme for olive farmers. If a farmer pays for his fertilizer upon purchasing, he receives a 15 percent reduction. If he receives credit and repayment takes place immediately after harvest, he receives a 10 percent reduction. The base price for these reductions is the wholesale price in Tunis. The actual subsidy is higher than stated, as a farmer would normally have to pay the retail price in Tunis (30.000 dinars) plus transport and handling costs. Credit is provided to farmers and repayment is in cash.

The Office of Wine (OV) has a monopoly on the domestic (wholesale) and foreign sale of wine. It has the power to delegate the above activities to others, including cooperatives and private concerns. Some grape farmers sell directly to the Office. The remainder belong to the Central Cooperative

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29/ Food and Agricultural Organization and the Swedish International Development Agency.

Union of Grape Growers and sell their wine grapes to private dealers. OV estimates that their farmers account for approximately 10 percent of the wine grapes grown in Tunisia.

OV orders fertilizer for its member farmers from the fertilizer producers. Members pay the wholesale price for fertilizers. OV began a credit program for fertilizer in 1973-74. Credit is available from OV to the growers. Repayment is in kind after harvest.

The Interprofessional Group of Citrus and Fruits (GIAF) is currently involved in a pilot fertilization program with 150 citrus and fruit growers. The program is an extension activity with the objective of introducing regular fertilization practices to the sector. Under the program, the 150 growers receive credit for their fertilizer purchases over a four year period.

In November 1973, GIAF asked the Minister of Agriculture to subsidize the use of potassium fertilizers. It is concerned about effects of continuing price increases on citrus and fruit growers.

Cooperatives

The Central Cooperative of Cereal Crops (CCGC) is a marketing cooperative. The Office of Cereals has granted it the privilege of purchasing and storing cereals. In addition, the CCGC offers to members technical advice, the sale of agricultural inputs, and production credit.

All of CCGC's centers are located in the cereal growing areas of the north. In 1973, 11 of its 32 centers distributed fertilizer. CCGC's market share of retail sales on a gouvernorat basis ranges from 24.7 percent in Bizerte to 2.1 percent in Nebeul, Table 22. Average sales for the 11 centers was 1,184.6 metric tons in 1973. Total sales were 13,030.2 metric tons. This sale volume represented 9.7 percent of total retail sales in Tunisia. Generally, CCGC's centers do not experience a storage area shortage for their fertilizer stocks.

All of CCGC's centers are located at or near rail lines. In 1973, approximately 31 percent of its center's wholesale purchases were received via rail transport. The remainder was transported by truck, either trucks owned by CCGC or the semi-governmental Regional Transport Society (SRT).

The average market area radius of these centers was 26 kilometers. Fertilizer is seldom delivered to farmers. Producers generally transport fertilizer from retail outlet to their farms. It is estimated that 78 percent of the farmers use trucks or tractors and wagons to pick up their supplies.

Approximately 2,300 farmers purchased fertilizer from CCGC in 1973. Purchases are applied mostly on cereal crops. In 1973, 90 percent of its

sales were applied on cereal crops (77.9 percent on wheat), 8.8 percent on garden crops, and 1.2 percent on tree crops.

CCGC offers no price discounts. Any farmer can purchase fertilizer at its centers at cost. Cereal farmers or members can purchase on credit at a few select centers. Credit is advanced until August. Repayment is in cash and can be extended until after harvest. No interest rate is charged.

The Central Wheat Cooperative (COCEBLE), whose management comes under governmental control, is similar to CCGC in functions, activities, and retail characteristics. In 1973, 11 of its 17 centers distributed fertilizers. Most of its centers are located in the cereal growing areas of the northern region. Its market share of retail sales within gouvernorats varies from 36.3 percent in Tunis Sud to 9.7 percent in Bizerte, Table 22. COCEBLE's fertilizer sales in 1973 totaled 11,393.5 metric tons. The average sales per retail center were 1,035.8 metric tons. Its sales represented 8.5 percent of all retail sales in Tunisia.

COCEBLE's centers are located at or near rail lines. However, only 6.3 percent of its centers' purchases were received via rail. The remainder was shipped in trucks owned by COCEBLE or by SRT.

COCEBLE operates on a nonprofit basis. It offers no price discounts nor does it deliver fertilizer to its customers. Its credit program requires a down payment of 33 1/3 percent at purchase, with the balance due after harvest in either cash or kind. A two to three percent interest rate is charged on the outstanding balance.

The Central Cooperative Union of Grape Growers (UCCV) is involved in wine grape purchasing, wine production, sales, and exportation. Its members own approximately 90 percent of the area planted in wine grapes in Tunisia.

UCCV places fertilizer orders with STEC for its members. In 1973, UCCV members purchased 1,516.3 metric tons of fertilizer from STEC (647.3 metric tons of TSP and 359.0 metric tons of potassium sulfate). When growers need supplies, they obtain authorization from UCCV and from the wholesaler and pick up their supplies individually. Credit is available from UCCV to the growers who purchase their fertilizer at the wholesale price. Repayment is in kind after harvest.

Other Cooperatives

Other types of cooperatives operated 42 retail outlets in 1973 which retailed fertilizers. These cooperatives distribute agricultural inputs to farmers, provide some technical advice and assistance, and in some instances, purchase, process, store, and sell farm commodities in domestic and/or foreign markets. They are quite diverse with respect

to sales to noncooperative members, fertilizer pricing policies, and the extent of government intervention.

These cooperatives have in common the practice of retailing fertilizers at prices competitive with independent retailers. In 1973, they sold 8,759 metric tons (6.5 percent of total retail sales) of fertilizer, averaging 186 metric tons per outlet. The heaviest concentration of these outlets is in the gouvernorats of Nebeul (16) and Bizerte (9). Their market share of retail sales within gouvernorats is not large, ranging from 20.6 percent in Nebeul to 2.2 percent in Gabes. The survey indicates that sales of these cooperatives have been increasing since 1971. Sales in 1972 were 27.3 percent higher than in 1971, and 1973 sales were 9.5 percent higher than in 1972.

Seven of this type of cooperative were interviewed. Only one of the seven offered price discounts. Its discounts were on a volume discount. Credit was offered by six with two requiring repayment in kind.

The average storage capacity of these outlets is 70.1 metric tons. Insufficient storage capacity was reported as a problem by three.

Located principally in the garden crop regions, their distribution areas averaged 14.1 kilometers in radius. In 1973, an estimated 27,900 farmers purchased fertilizer at these outlets. Most of the customers possessed five hectares or less of land. The majority of them were small farmers, 76.6 percent of whom used animal traction to transport their fertilizer purchases. Approximately 61.8 percent of total sales were used on garden crops, 27.3 percent on tree crops, and 9.4 percent on wheat.

Independents

There are 128 private individuals and companies performing the retail function in the fertilizer market in Tunisia. In 1973, they sold 38,843.6 metric tons of fertilizer. Their share of the Tunisian retail market was 28.9 percent. Most of these outlets are located in the gouvernorats of Nebeul (53), Bizerte (35), and Tunis (18). Their shares of retail sales were also greatest in those gouvernorats - Nebeul (69.9 percent), Tunis (64.3 percent), and Gabes (49.5 percent). Less than 1.0 percent of their outlets are located in the cereal production areas of Beja, Jendouba, Le Kef, and Tunis Sud, Table 22. Fifteen independents were interviewed for this study.

Sales volume of the independents was generally small, with approximately 70 percent retailing 175 metric tons or less in 1973. Only eight of the 127 retailers had sales in excess of 550 metric tons, with the largest recording a sales volume of 6,688 metric tons. These eight retailers accounted for close to 50 percent of all sales for this retail grouping. On the average, each outlet serves an area with a radius of 10.6 kilometers.

In the garden spot areas, their fertilizer sales typically represent a high proportion of total merchandise sales. They sell only fertilizer or small volumes of other products, such as foodstuffs, machinery parts, gasoline, etc. In the cereal production regions, the retailers are more diversified. Fertilizer sales represent a small proportion of their total sales as they are involved in the selling of automotive parts, hardware, and foodstuffs.

Most of these retailers are located away from rail lines. Only three of the 15 independent retailers interviewed made use of the rail system in shipping fertilizer from factory outlets to their stores. Six owned trucks. Of those interviewed, three reported periodic difficulties in procuring transport services.

The independent retailers serve principally the garden crop sector. In 1973, 60.2 percent of its sales was used on garden crops, 20.7 percent on wheat, and 17.7 percent on tree crops. In 1973, approximately 21,700 farmers purchased fertilizers from independent retailers. Most of the farmers farmed five hectares or less. Approximately 86.8 percent of their customers transported their purchases by the means of animal traction. Only one independent delivered fertilizer to its customers.

Independent retailers offered a number of services to customers. Ten of the 15 provided credit, two of which permitted repayment in kind. Quantity discounts were offered by three retailers. Most of the retailers indicated they offer technical advice to their customers.

Total sales for this retailer group have increased since 1971. If the largest volume retailer is omitted, their 1972 sales increased 24.6 percent over 1971, and 1973 sales increased 5.2 percent over 1972. With the largest volume retailer included, sales for 1973 declined 1.3 percent over those of 1972. Although sales have expanded for most independent retailers, there is no apparent storage facility shortage for this retailer group. The average storage capacity is 87.2 metric tons.

Prices and Margins in the Retail Market for Fertilizer

Prices and Price Variation

Officially, there is a fixed retail price for nitrogen, NSP, and TSP. These are fixed at 30.000 TD, 15.900 TD, and 36.000 TD per metric ton, repsectively. But the prices are fixed f.o.b. Tunis. Retailers who buy from wholesalers are allowed to add costs of transport and associated handling. There are no schedules for these costs, so that the retailers actually have considerable latitude in pricing.

An analysis of retail prices, as reported for this study, revealed that price variation between regions was not always explainable by a transport and handling differential. In the gouvernorats of Nebeul and

Bizerte, retail prices show little relationship to distance from Tunis, Table 23. In fact, for NSP in March 1974, a price of 18.000 TD was most commonly reported regardless of distance from Tunis.

A regression analysis was conducted to determine what explained the price patterns in Tunisia, other than the transport and associated handling cost differentials. Price was used as the dependent variable. The independent variables were: sales volume, number of retailers in a market area, size of market area, market share, number of customers, the means of transport used by the majority of a retailer's customers (a proxy for the type of customers serviced by a retailer), the relative importance of fertilizer sales volume to a retailer's total sales, and various dummy variables such as credit policies, price discounts, and the presence of centers of the cereal organizations in a market area.

The statistical results were unsatisfactory. This may have been due in part to the lack of response or the poor data that was obtained on transport and handling costs for the individual retailers. Even those who did respond may vary the mode of transport used in receiving their shipments depending upon circumstances. For instance, if a retailer urgently needed supplies, he would use truck transport rather than rail (assuming the rail option was open to him). If the SRT transport services were not available, he may have rented the services of a privately owned truck. A few retailers owned their own trucks and, in one instance, a retailer occasionally used his own car for purchases in Tunis.

Price variation was most strongly associated with the level of retail outlet concentration. Prices tended to be low and more uniform in areas where retailer concentration was heavy. The presence of a cereal center also appeared to influence the prices of independent and cooperative retailers, especially if there were several of the latter in a town. The highest prices were generally in the cereal areas where only one independent retailer coexisted with the cereal centers.

The amount by which independents' prices exceeded the Office of Cereals' price appeared to be influenced by the number of competitive independents or cooperatives in the area. Table 24 lists the prices of independent retailers and Office of Cereals' centers in the towns of Teboursouk (Beja), Le Kef (Le Kef), Jendouba (Jendouba), Korba (Nebeul), and Mateur (Bizerte). It shows that in Teboursouk and Le Kef, with one independent each, the differentials in price for ammonium nitrate were 7.000 TD and 3.790 TD, respectively, above the Office of Cereals centers' prices. In the Korba area where there are seven independent and cooperative retailers, one independent's price of ammonium nitrate was less than the Office of Cereals' price.

The survey did reveal that the majority of the private and cooperative retailers were charging prices lower than the controlled ammonium nitrate price; all but one were charging more for NSP, and five out of 13 had retail prices for TSP that exceeded the control price after our adjustments

Table 23. Observed Independent and Cooperative Retail Prices of the Principal Fertilizers in the Gouvernorats of Bizerte and Nebeul, March 1974.

Gouvernorat	Town	Distance from Tunis	Price			Number of Retailers	
			NSP	TSP	Ammonium Nitrate 33.3%	Cereals Organization	Independent and Cooperative
		(kilometers)	----- TD/metric ton --------				
Bizerte	El Alia	53	18.000	---	32.000	---	6
	El Alia	53	18.000	37.000 2/	33.000	---	6
	Menzel Djemila 1/	57	18.500	38.500 2/	33.000 2/	---	1
	Sounine	57	---	---	32.500 2/	---	3
	Ras Djebel	61	18.000	---	32.000	1	8
	Ras Djebel	61	19.000 2/	40.000 2/	32.000	1	8
	Ghar El Meleth	62	---	---	32.000	---	2
	Metline	62	18.000	40.000 2/	32.000	---	3
	Mateur	68	19.000	38.000 2/	31.300	3	3
	Menzel Bourguiba	70	17.600	36.500	31.200	1	6
Nebeul							
	Menzel Bon Zelfa	43	18.000	---	30.500	---	5
	Beni Khalled	50	18.000	37.000	31.000	---	5
	Korba	68	18.100	36.000	31.000	1	4
	Dar El Hajjaj	75	18.000	---	31.000	---	1
	Somaa	75	18.000	---	32.000 2/	---	4
	Henchir Lebna	83	18.080	39.000 2/	32.000	---	1
	Menzel Temine	95	16.800	36.000	31.000	1	9
	Menzel Temine	95	18.000	37.000	31.000	1	9
	Menzel Temine	95	18.000	---	---	1	9
	Menzel Temine	95	18.000	---	---	1	9
	Haourrai	98	18.500	38.000	32.000	1	4
	Haourrai	98	18.500	---	32.000	1	4
	Kelibia	107	18.000	37.000	31.000	1	9
	Kelibia	107	18.500	37.000	32.000	1	9

1/ A cooperative that offered price discounts to members.
2/ Purchased supplies from another retailer.
Source: Field Surveys.

Table 24. A Comparison of Fertilizer Retail Prices Between Office of Cereals' Centers and Independent Retailers, March 1974.

Gouvernorat	Town	Type of Retail Outlet	Price			Number of Retailers	
			NSP	TSP	Ammonium Nitrate 33.3%	Cereals Organization	Independent and Cooperative
			----- TD/metric ton --------				
Beja							
	Teboursouk	Office of Cereals	17.900	35.500	31.000	1	1
	Teboursouk	Independent	19.000	---	38.000	1	1
Le Kef							
	Le Kef	Office of Cereals	18.210	35.500	31.210	3	1
	Le Kef	Independent	19.000 1/	36.000	35.000	3	1
Jendouba							
	Jendouba	Office of Cereals	17.580	35.500	30.880	2	3
	Jendouba	Independent	18.500	36.000	32.000	2	3
Bizerte							
	Mateur	Office of Cereals	16.990	---	30.090	3	3
	Mateur	Independent	19.000	38.000 2/	31.300	3	3
Nebeul							
	Korba	Office of Cereals	17.640	35.500	31.240	1	7
	Korba	Independent 3/	18.000	---	31.300	1	7

1/ Purchased from STEC during period of unauthorized price increase.
2/ Purchased supplies from a retailer.
3/ Located seven kilometers from Korba.
Source: Field Surveys.

for transport and associated handling costs. Since there was no fixed fee schedule for transport and handling, the fixed retail price was less than binding.

Retail Margins

The government's price control policy has established legal retail margins that are to include the retailer's overhead and variable costs (other than transport and associated handling), as well as a profit. This margin is the difference between the fixed wholesale price and the fixed retail price f.o.b. Tunis. These margins are 0.300 TD for NSP and 1.500 TD for TSP and ammonium nitrate. As a percentage of wholesale price, the NSP margin is 1.9 percent, TSP - 4.3 percent, and ammonium nitrate - 5.3 percent.

Throughout the country, the independent's and cooperative's average retail margin on all fertilizer sales fall within the range of 2.4 - 6.1 percent of the wholesale price Tunis, Table 25. On the average, the independent retailer's margins are higher than the cooperative's. Margins of the Office of Cereals' centers are lowest, Table 25. The difference between average margins of the independents and the Office of Cereals (nonprofit margin) gives some perspective of the profitability of fertilizer sales for the independents. 30/ The results of this calculation reveal that the independent's profit on NSP sales is 3.5 percent of wholesale price and on ammonium nitrate sales, 2.6 percent of the wholesale price.

Geographically, the independent retailer's margins are the lowest in Nebeul and the highest in Beja and Le Kef. Generally, the independent retailers in the major garden spot areas (Bizerte and Nebeul) have the lowest margins, while in the major cereal areas, their margins are considerably higher.

Shortages of Fertilizer at Retail

There is some evidence that fertilizer shortages are occurring at the retail level of the market. First, the field survey found that the majority number of independent retailers interviewed in the garden spot areas experienced difficulty during 1973 and in early 1974 in filling their orders at the wholesale level. Of the independent retailers interviewed, 11 out of 15 reported such difficulties. However, only five actually depleted their stocks of ammonium nitrate and they were located in three different gouvernorats. In those towns where stocks of a retailer had been depleted, other retailers usually had stocks on hand.

The levels of retailer margins indicate that shortages of fertilizer are not widespread or continual. For example, the average independent retailer margin is 1.298 TD for ammonium nitrate, which is lower than

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30/ The perspective is a rough approximation. The Office of Cereals' costs are probably lower because of larger volumes handled.

Table 25. Average Retail Margins [1/] of Principal Fertilizers by Type of Retailer, March 1974.

Type of Retailer	NSP		TSP		Ammonium Nitrate 33.5%	
	Average Margin/ Metric Ton	Percent of Wholesale	Average Margin/ Metric Ton	Percent of Wholesale	Average Margin/ Metric Ton	Percent of Wholesale
	----- TD -----		----- TD -----		----- TD -----	
Independent	0.9516	6.1	0.8423	2.4	1.2984	4.6
Cooperative	0.7627	4.9	0.9430	2.7	1.1411	4.0
Office of Cereals	0.3989	2.6	---	---	0.5804	2.0

1/ The margin calculations are the differences between the retailer's price and the wholesale price minus transport and associated handling costs.

Source: Field Surveys.

the legally allowed margin of 1.500 TD. If there were general shortages of ammonium nitrate throughout Tunisia, one would not expect the average margin to be below the legal minimums. In fact, the expectation is greater so that retailers would charge the controlled price (retail price plus transport and handling costs) and obtain the legal margin. If prices are not closely regulated by the GOT, margins may exceed the legal amount as retailers set their price at a higher market equilibrium level during shortage periods.

While shortages do exist in the fertilizer market, the more severe shortages are typically for nitrogen fertilizers in the cereal growing areas. In these areas, the farmers are almost exclusively dependent upon the cereal organizations for their supplies. Only two out of the 17 Office of Cereals' centers interviewed claimed to have no problems in procuring fertilizer supplies, while seven experienced occasional depletion in stocks of ammonium nitrate. The higher retail margins for independents in these areas may be a reflection of these shortages. For example, the single independent retailers in the towns of Le Kef and Teboursouk had retail margins of 4.347 TD and 7.700 TD, respectively, for ammonium nitrate. These margins were 3.845 TD and 6.920 TD, respectively, greater than the Office of Cereals' nonprofit margins in the same towns. They are also considerably higher than the average independent retailer's margin of ammonium nitrate in Nebeul, which was 0.668 TD.

Transport Cost, Methods, and Problems

The Transportation System

The transport network in Tunisia is well developed. Movements of goods within the interior have the alternative of moving by rail or truck. The rail network, which is controlled by the Tunisian National Society of Railroads (SNCFT), consists of close to 2,000 kilometers of track. The National Society of Transport, a semi-governmental agency with approximately 11 centers throughout the country, provides truck transport services in each gouvernorat. Other transport services are available through private individuals who own trucks. Many of these services are concentrated in the gouvernorats near Tunis.

Rail Transport - About 40 percent of wholesale fertilizer shipments move by rail. Rail transport in Tunisia is handicapped to some extent because of the existence of two gauges of rail. The southern and central regions of the country account for about two-thirds of the rail line, which is of narrow gauge. The wide and narrow gauge track junction is located in Tunis. Here, merchandise must be transshipped if shipments originating in either are to be moved to the other. The major wheat growing area of the country lie in both railroad regions. The two major garden crop areas of Bizerte and Nebeul are basically isolated from the rail network, Figure 10.

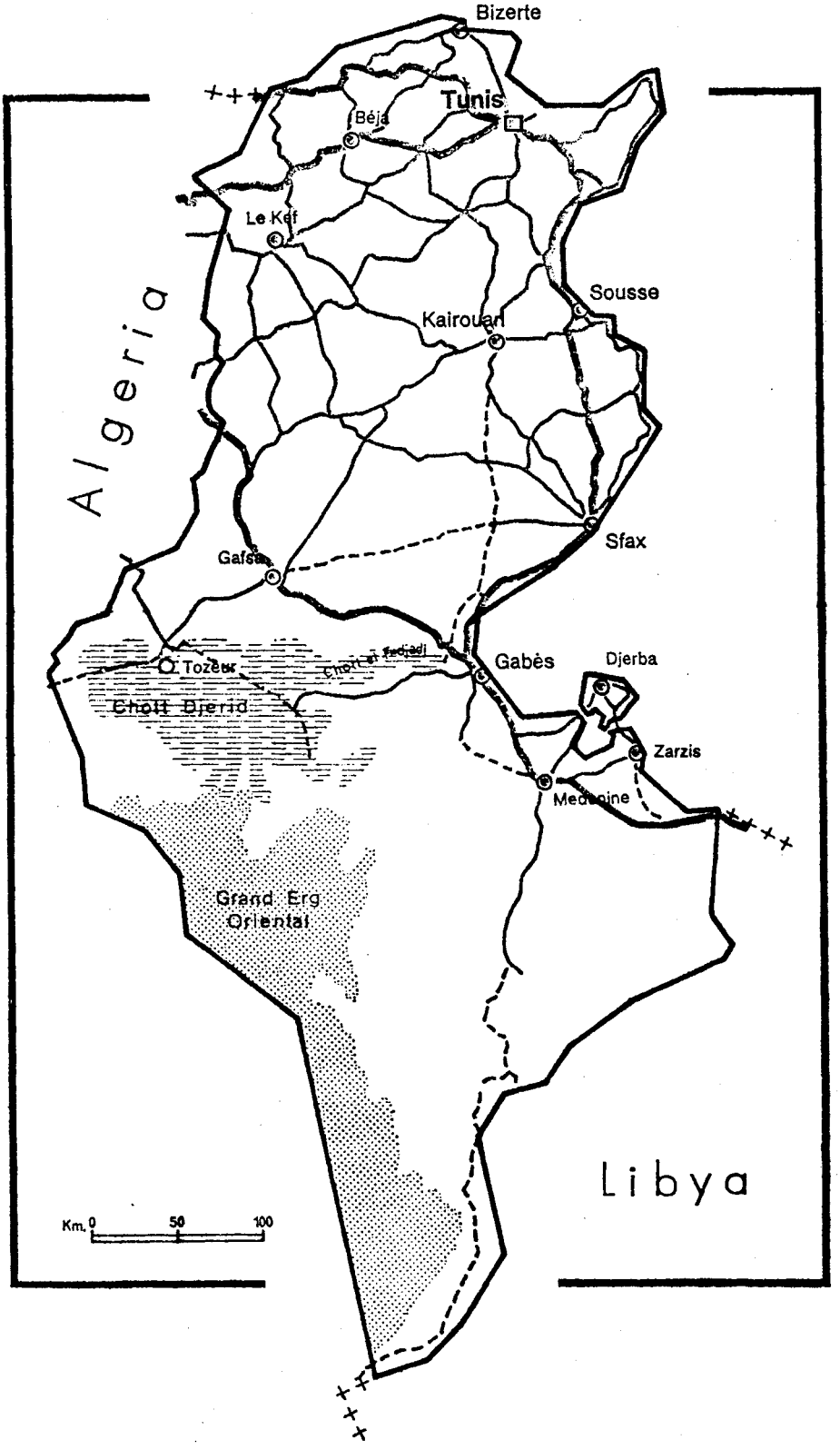

Figure 10. Rail Transport System in Tunisia.

Source: Paolo Mottura, The Banking System of Tunisia - 1956-1970, Cassa Di Risparmio Delle Provincie Lombarde, Milan, 1972.

STEC is the only fertilizer wholesaler that is located on the rail line; approximately two-thirds of its fertilizer shipments move by rail to retailers or consumers. The other two major producing companies (SEPCM and STIPCE) move most of their sales by truck.

In 1972 and 1973, 51.8 percent and 53.9 percent, respectively, of the fertilizer rail shipments were to the Cereal Organization's centers. The balance was shipped to independent and cooperative retailers, state farms, cooperative production units, or individual farmers, Table 26. It should be noted that the Cereal Organizations order fertilizer for and sell fertilizer to the state farms and cooperative production units in the interior. A good share of these sales move by rail directly to the purchaser.

Truck Transport - In 1973, approximately 60 percent of all fertilizer was transported by truck into the interior. Truck transport accounted for 33 percent of the shipments from STEC and close to 100 percent from SEPCM and STIPCE. The Office of Cereals' centers received approximately 30 percent of their fertilizer by truck, CCGC - 70 percent, and COCEBLE more than 90 percent. Independent retailers are highly dependent upon truck transport. STEC officials report that close to 90 percent of their fertilizer sales to independent retailers in Tunis are picked up by trucks.

Transport Rates

Cost of transporting fertilizer is based upon official rates for SNCFT and SRT. The rate schedules were adjusted in early 1974 to reflect increasing transportation costs. Neither the old nor the new truck schedules offer preferential rates for fertilizer since fertilizer is classified as "general merchandise." The rail rate schedule is classified by type of merchandise transported, and fertilizer is subject to a lower rate than some merchandise.

Under the old rail rate structure, fertilizer shipments of less than five metric tons moved at one rate and shipments of five metric tons and greater at another rate, Table 27 and Figure 11. The new structure established decreasing rates at ton intervals of 4, 6, 8, 10, 12, 16, and 20 or more. Overall, rail transport rates were increased for all quantities and distances, except those of 20 metric tons and greater, for distances over 100 kilometers (with a few exceptions). Shipments in the latter category now move at a lower cost. Rail rate increases were the greatest for four to six metric tons shipments. In general, rates were substantially increased for small volume shipments and short distance rates were increased more than long distance rates, Table 27.

The new truck transport rate legislation was effective in February 1974. The old rate structure dated from December 1951. Under the old legislation, the structure was set up for 0-3, 3-7, and greater than seven metric tons shipments. The new structure has fixed rates at less than

Table 26. Fertilizer Rail Transport in Tunisia, 1972 and 1973. [1/]

Destination	Origin	Office of Cereals	CCGC	COCEBLE	STEC	SEPCM	Others [2/]	Total
		1,000 metric tons						
Office of Cereals	1972	8.9	0.0	0.0	11.5	0.1	< 0.1	20.6
	1973	8.6	0.0	0.0	14.8	0.0	0.2	23.6
CCGC	1972	0.0	1.1	0.0	8.1	< 0.1	< 0.1	9.2
	1973	< 0.1	2.8	0.0	1.1	0.0	0.0	4.0
COCEBLE	1972	0.0	0.1	0.1	0.7	0.1	< 0.1	1.0
	1973	0.0	0.0	0.1	0.5	0.1	0.0	0.7
Others [2/]	1972	1.4	1.2	0.1	20.7	4.0	1.4	28.8
	1973	1.2	3.0	< 0.1	18.7	0.4	0.9	24.2
TOTAL	1972	10.3	2.4	0.2	41.0	4.2	1.5	59.6
	1973	9.8	5.8	0.1	35.1	0.6	1.1	52.5

1/ This table includes shipments from wholesalers to retailers and consumers. It also includes fertilizer shipments from storage areas of the cereal organizations to their centers.

2/ Includes individual farmers, state farms, cooperative production units, and other miscellaneous customers of the retailers and wholesalers.

Source: SNCFT.

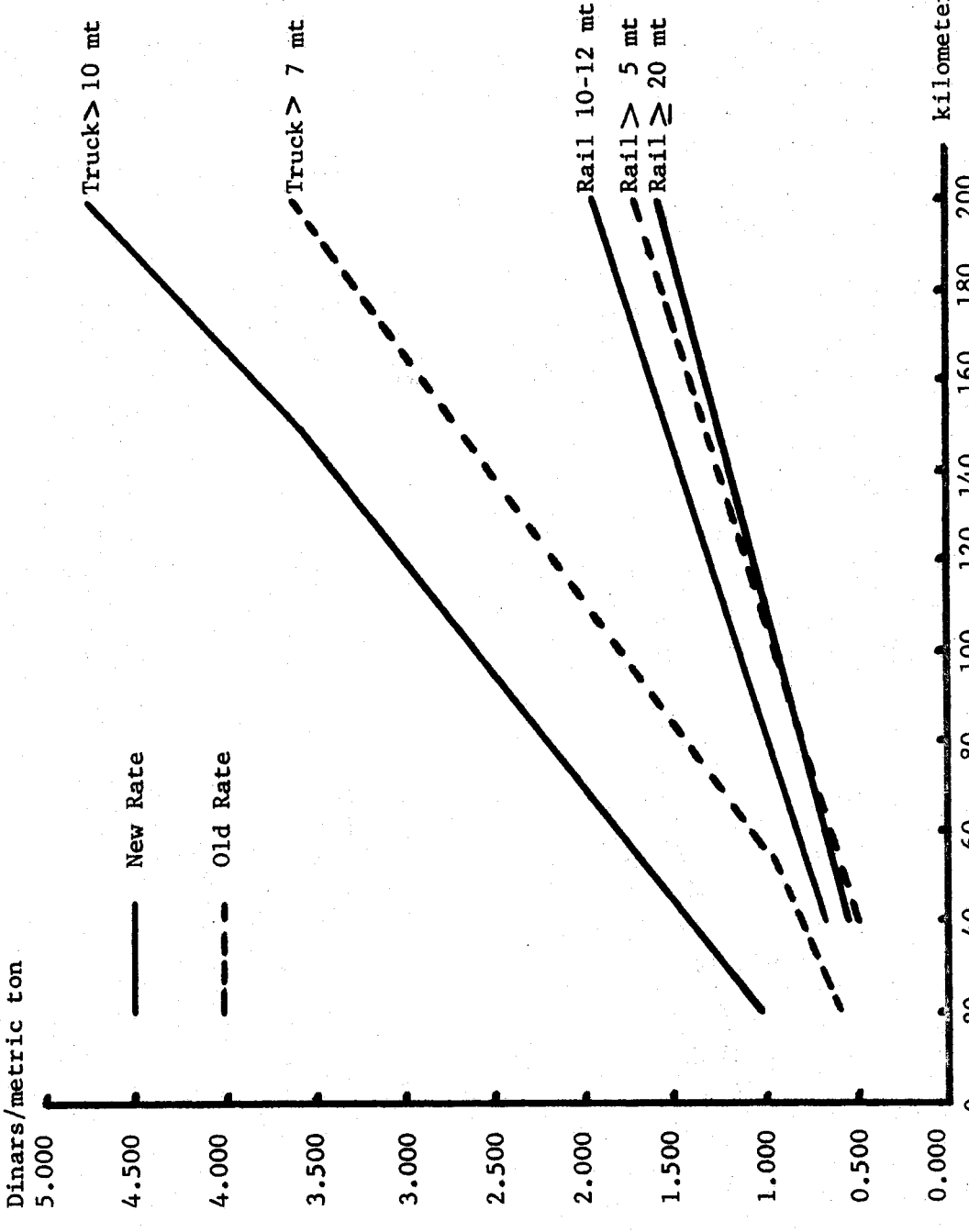

Figure 11. Comparison of the 1973 and 1974 Costs of Truck and Rail Transport in Tunisia.

Table 27. Changes in Rail Transport Rates from 1973 to 1974 by Volume and Distance.

Kilometers \ Metric Tons	5	10	15	20
	--- percent change ----			
34	166	33	25	10
76	148	24	16	2
105	136	18	11	- 3
125	134	17	10	- 4
149	132	16	9	- 4
170	129	15	8	- 6
202	133	16	9	- 4
248	129	15	8	- 6
278	124	12	5	- 8
306	125	12	6	- 8

Source: Office of Cereals.

5, 5-10, and greater than 10 metric tons shipments. Only those shipments of 10 metric tons or less and traveling less than 150 kilometers travel at a higher cost. Rate increases diminished as the distance of shipment approaches 150 kilometers. Increases were greatest for those shipments of 5-10 metric tons moving within a 0-20 kilometer range, Table 28.

Table 28. Changes in Truck Transport Rates from 1973 to 1974 by Volume and Distance.

Kilometers \ Metric Tons	5	10	15	20
	--- percent change ----			
10	127	209	147	147
25	121	204	63	63
50	75	78	42	42
75	17	56	22	22
100	8	44	11	11
150	0	0	0	0

Source: Lois et Réglements, Journal Officiel de la République Tunisienne, 117^{e} Année - N^{o} 13, Tunis, mardi 19 fevrier 1974.

Under both the new and old rate schedules, truck transport costs are higher than rail rates. The new rate schedule increased truck rates more than rail rates in both absolute and percentage terms, see Figure 11 and Tables 27 and 28.

Transport Costs and Their Impact on Fertilizer Movements

The new transport rate structure increased fertilizer prices in those areas within 100 kilometers of wholesale outlets and elsewhere in Tunisia where a retailer outlet is not serviced by rail. The rate increases bear hardest on the private retail sector as they are more dependent on truck transport services.

Most of the private retailers in Nebeul and Bizerte are dependent on truck transport and they typically transport small quantities. The rate structure changes have meant a larger increase in fertilizer prices to farmers in these areas than those in the cereal growing regions, where the cereal organizations dominate the fertilizer market. The cereal organizations more frequently rely on rail transport to ship larger quantities. For example, if an independent retailer ships 10 metric tons of fertilizer to the t wn of Menzel Temine, the rate change has increased his truck transport costs by 46.2 percent or 0.790 TD per metric ton. If he transports his shipment via rail to Nebeul and by truck from Nebeul, his costs have increased 52.8 percent or 0.877 TD per metric ton. In Le Kef where the Cereal Organization dominates the fertilizer market, its rail transport costs for 10 metric ton shipments will increase 16.3 percent or 0.278 TD. For shipments of 20 metric tons or greater, its transport costs will decrease 4.2 percent or 0.072 TD per metric ton. The general conclusion can be drawn that the rate change increased fertilizer prices relatively less for the farmers in the cereal sector than those in the garden spot areas.

The Transport Bottleneck

The rail and truck transport systems have been cited by the government as sources of bottlenecks to fertilizer distribution during the peak demand periods. In 1973, over 50 percent of the fertilizer sold by the wholesalers was shipped during the four month period, August-November. In 1972, the SNCFT transported 43,529 metric tons during this period or 73.0 percent of its total fertilizer shipments for the year. During this period, if rail cars are not promptly unloaded at their destination or if severe flooding occurs, timely distribution of fertilizer is hampered considerably.

The government, in the fall of the year, regularly becomes involved in coordinating the movement of fertilizers to the cereal organizations so as to assure an adequate fertilizer supply to cereal farmers. Most of their efforts are directed to assuring rail car availability of fertilizer movements.

The independent, cooperative, and direct consumers who rely more on the truck transport system also have transport difficulties. Several problems associated with the transport services of the SRT have been cited:

(1) Insufficient number of trucks at its disposal;

(2) Trucks in generally poor operating condition;

(3) Occasional refusals to ship fertilizer to destinations far from trucking centers.

While bottleneck difficulty could be alleviated by a sizeable investment in the rail and truck transport systems, it could be partially overcome by use of higher analysis nitrogen and phosphate fertilizers. For phosphate fertilizer, this means use of TSP rather than NSP. Thus, for August through December 1973, 54,000 tons of NSP and TSP (85.2 percent of annual shipments) were shipped by wholesalers. More than half of this tonnage (30,000 tons) was NSP. The tonnage could have been reduced by 35.4 percent, or close to 20,000 metric tons, had farmers purchased only TSP.

This transport bottleneck problem is considered a major one for fertilizer distributors and is most likely a check to increased use of fertilizer. However, it appears to be only a symptom of the larger problem of the distributor's unwillingness to build up stocks well before the fertilizer application periods. This unwillingness is related to inadequate storage areas and the sales risk associated with rainfall variation.

IV. AN ANALYSIS OF IMPACTS OF PRICE CONTROLS, TAXES, AND SUBSIDIES

The net effects of price controls, subsidies, and production taxes on manufacturers and importers of fertilizer and on farmers should be considered carefully when employing these devices or in deciding on the necessary levels. The general effects can be illustrated with standard theory of the firm. We will examine impacts of fertilizer use by individual farmers on market supply of farm products and on manufacturers and importers. Government costs and returns from subsidies and taxes will also be examined.

Impacts on Fertilizer Use by Individual Farmers

The individual farmer's demand for fertilizer is determined by the product of the response of production of each farm product to additional units of fertilizer at each level of use and the price paid for the additional output. For a given area of land, say a hectare, the value of additional product (VMP) determines the price that can be paid for fertilizer for each level of use such that the net return to the unit of land is maximized.

This relationship is shown graphically. Though it may be increasing over some range of use, it always declines at some level of use. This declining range is the relevant one for determining level of use. In Figure 12, the curve VMP_n is the farmer's demand curve. For any given price of nitrogen, P_N, and the price of bread wheat, P_{BW}, held constant, the intersection of this price with the VMP curve determines the quantity of nitrogen to be used. Under conditions of a constant bread wheat price, summation of all farmers' VMP curves will yield the demand curve of fertilizer for the entire country. At a price of P_1 for nitrogen, the optimum level of use for this farmer is q_1 units per hectare. If the price of fertilizer increases from P_1 to P_2, then the quantity of fertilizer demanded will decrease from q_1 to q_2; the optimizing point of use where P_N equals VMP_N is at a higher point on the demand curve. If the price of bread wheat increases and the P_N is held constant, then the VMP_n curve will shift right to VMP' and the quantity of fertilizer will increase from q_1 to q_3.

This theoretical model can be applied to the results of fertilizer field trials and demonstration plots. For example, Table 29 depicts the results of a fertilizer field trial conducted by FAO in the late 1960's. 31/ The price of bread wheat is the fixed producer price less a tax levied on the sale of wheat (six percent). The fertilizer prices

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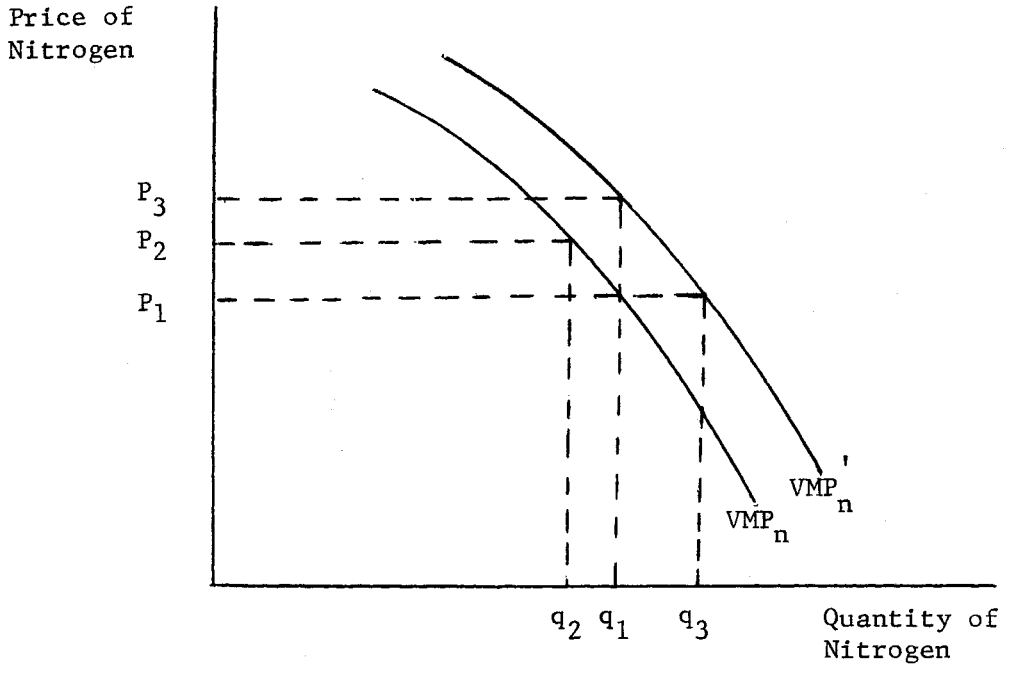
31/ Coursier and Jeandrain.

Table 29. Bread Wheat Fertilizer Trials and the Profitability of Fertilizer Use, 1973 and 1974.

Q_N	ΔN	Q_{BW}	ΔQ_{BW}	MMP	1973 Price			1974 Price		
					P_{BW} 1/	VMP	P_N 2/	P_{BW} 3/	VMP	P_N 2/
---------- kg/ha ----------					dinars/mt	dinars/kg		dinars/mt	dinars/kg	
0		2,182								
	60		632	10.5	42	0.441	0.120	51	0.536	0.180
60		2,814								
	30		295	9.8	42	0.412	0.120	51	0.500	0.180
90		3,109								
	30		119	4.0	42	0.168	0.120	51	0.204	0.180
120		3,228								

1/ A sales tax of six percent is subtracted from the controlled price, 45.000 Tunisian dinars (TD).
2/ This price or cost includes farm spreading costs plus retail price.
3/ The controlled price was 55.000 TD (less production tax).
Source: Coursier and Jeandrain, page 33.

Figure 12. Individual Farm Demand Curve for Nitrogen Fertilizer.



are those of the Office of Cereals' center in Mateur (where the trial was conducted) plus spreading costs as quoted by FAO (1.000 TD per quintal per hectare). Farmer transport costs are not included in the fertilizer prices or costs.

The results reveal that use somewhat greater than 105 units of N was the economic optimum in 1973 because VMP (0.168 TD), the value of the extra product, exceeds the cost of nitrogen, P_N (0.120 TD), at this level. If we substitute the higher controlled prices for bread wheat and nitrogen fertilizer in 1974, the value of the VMP (0.204 TD) still exceeds the price of nitrogen, P_N (0.180 TD), even at the highest level of use indicated here. However, the price changes have lowered the magnitude of the difference from 0.048 TD to 0.024 TD. The profit maximization level is still greater than 105 kilograms of N, but the price change has reduced the economic optimum level.

The analysis can yield a precise estimate of the economic optimum rate of fertilizer application. However, farmers' real costs may be higher and, consequently, his application rate lowers for several reasons. Farmers may discount the return to fertilizer because of:

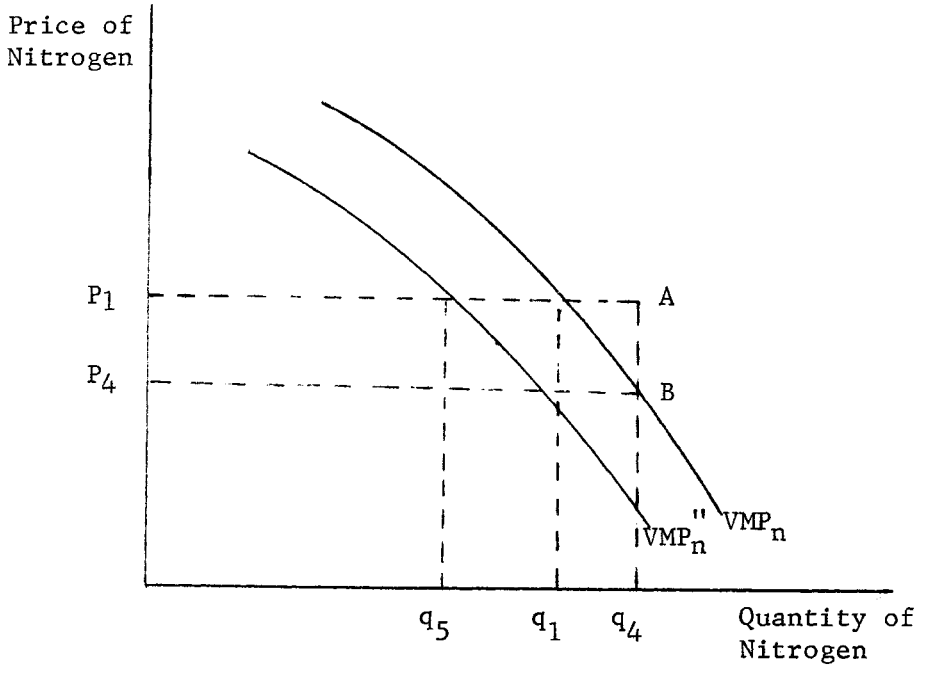
(1) Interest on credit for fertilizer;

(2) Coverage of risks and uncertainties of returns over a cycle of a year;

(3) Associated costs of fertilizer use, such as labor, plant protection, additional weeding, etc.

The impact of price fixing and subsidization of imports and its costs can be illustrated graphically as in Figure 13. First, with no price controls, the Tunisian farmer purchases his nitrogen fertilizer at the world market price plus the importer's costs, or P_1 (46.750 TD per metric ton for ammonium nitrate in 1969), and uses the quantity of nitrogen q_1. In 1970, the GOT fixed the price at 30.000 TD per metric ton, less than the world market price. In Figure 13, this could be represented by P_4. Here, the farmer increases fertilizer use to q_4. The farmer's level of use increases from q_1 to q_4. To assure that the suppliers would provide fertilizers at this price, the GOT pays a subsidy to fertilizer producers. For each hectare of farm production, this is represented by the area P_1ABP_4. Whenever the world market price increases as it did in 1973, the subsidy costs for the GOT increase.

Figure 13. The Impact of Price Fixing and Subsidization on Individual Farmer Demand for Fertilizer.

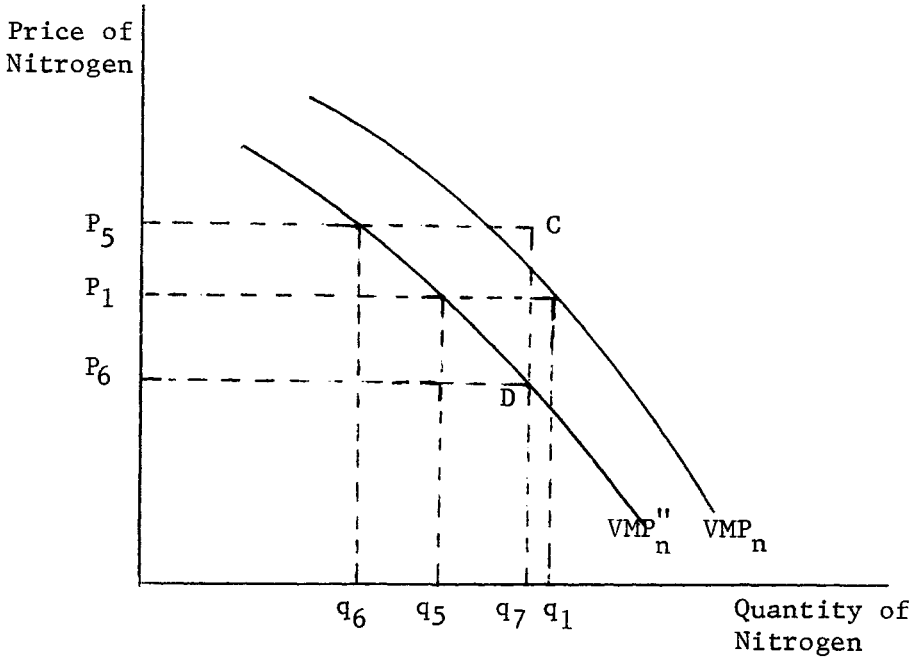


The impact of farm production taxes on the demand for fertilizer used in producing these products can also be illustrated. In Figure 13, curve VMP illustrates the demand for fertilizer when the farmer receives a nontaxed market price. Recall that for individual farmers, VMP is calculated for each level of fertilizer use by multiplying the additional output per kilo of fertilizer times the product price. A reduced price because of the imposition of a tax on production, other things being equal, shifts the demand curve to the left to VMP". Thus, at a given

fertilizer price of P_1, quantity q_1 is taken by the farmer without the production tax and q_5 is taken with the production tax. In effect, the tax lowers fertilizer consumption. It also implies a smaller supply of wheat.

Figure 14 illustrates the impact on farm use of fertilizer of both taxes on manufacturers or importers of fertilizer and taxes on farm products. VMP again is the demand for fertilizer for one farmer. As described above, the agricultural production tax shifts his demand to the left to VMP''. It reduced the level of fertilizer use from q_1 to q_5 at a price of P_1. If fertilizer production is taxed, then the price a farmer pays for his fertilizer increases and fertilizer use falls even farther. If the tax causes fertilizer price to rise from P_1 to P_5, consumption falls from q_5 to q_6. Both taxes have reduced the farmers consumption of fertilizer.

Figure 14. The Impact of Taxation and Subsidization on Individual Farmer Demand for Fertilizer.



To enable fertilizer producers to sell at fixed prices, the GOT decided to subsidize the production of nitrogen and NSP. If they set prices below the pretax market level, say P_6, the quantity of fertilizer taken by the farmer will increase to q_7 and offset some of the effects of the fertilizer production tax and farm production taxes. The magnitude of this offset depends upon the slope of the demand curve and the level of the controlled price. However, in order to obtain necessary fertilizer supplies with the fixed prices and taxes, the government is forced to pay a subsidy to fertilizer producers of $(P_5 - P_6)$ times q_7 or the area represented by P_5CDP_6. Though these policies are conflicting in terms of impacts on farm production, the GOT may find this to be a useful instrument of cash management if collections lag disbursement.

Impacts on Market Supply of Farm Products

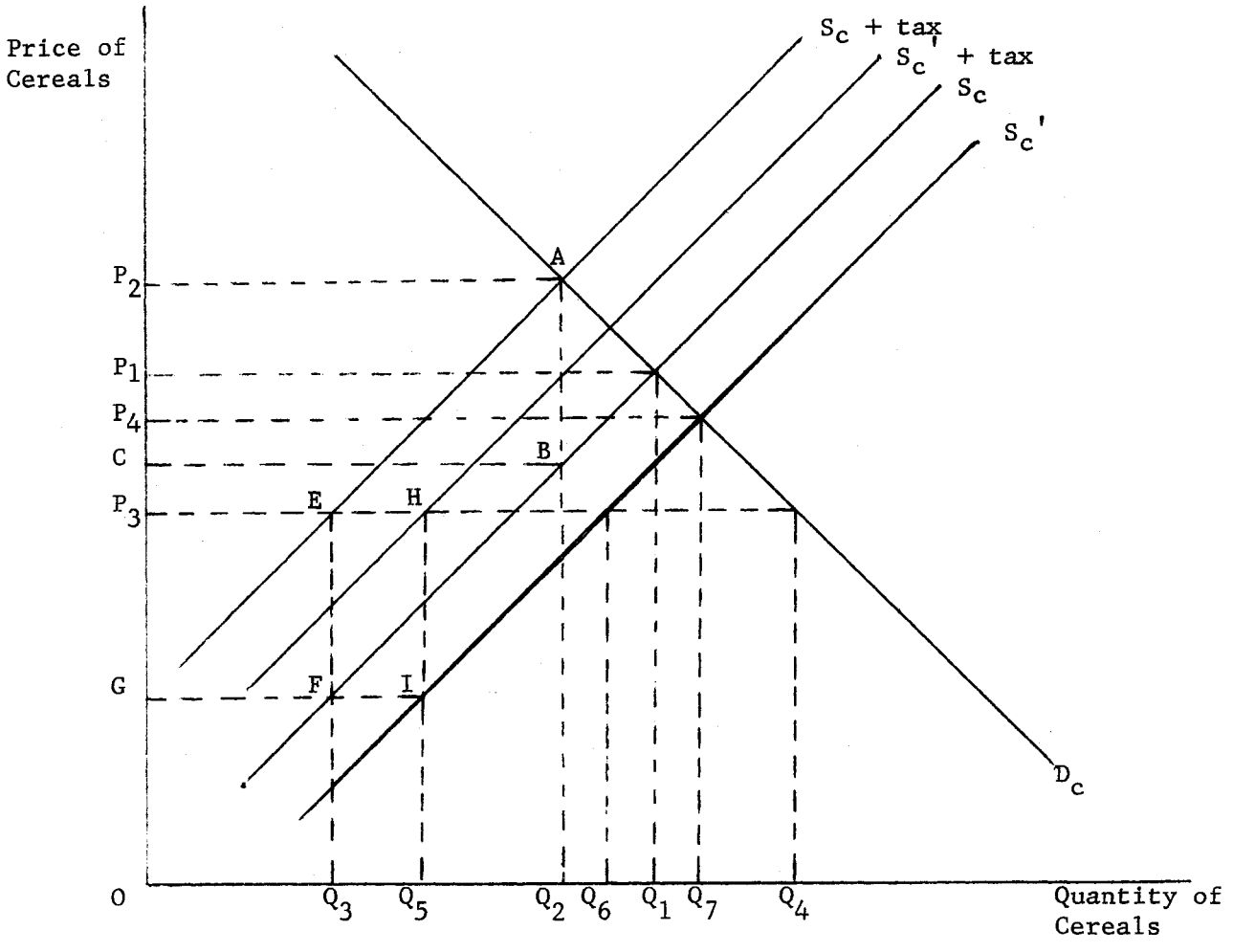
An analysis of the tax and subsidy policy on the product side of the market illustrates the conflicting effects in farm product markets, Figure 15. D_c is the demand for domestically produced cereals in Tunisia. S_c is the supply of domestically produced cereals. P_1 is the price for cereals at market equilibrium prices prior to the imposition of the tax; Q_1 is the quantity of wheat supplied by the farmer. The imposition of the tax reduces the net cereal price to farmers. The tax is viewed by farmers as a cost; thus, the industry supply curve, S_c, shifts to the left to S_c + tax as his costs increase. The new equilibrium point A results in a higher price to consumers, P_2, and a smaller quantity supplied by farmers, Q_2. However, the net price to producers, P_2 less the tax, is less than before the tax. After the tax, both farmers and consumers are worse off. The government tax revenue is indicated by the area P_2ABC.

The control of cereal prices by the GOT additionally affects wheat production as well as the receipts. Assume that the wheat price is fixed below the domestic free market equilibrium price at P_3. The lower price to farmers reduces supply still more to Q_3. The reduced domestic supply results in a need to import cereals to meet domestic need. Import needs are the difference between Q_4 and Q_3. The lower production results in a reduction of government revenue by $P_2ABC - P_3EFG$.

The subsidization of fertilizer manufacturers and importers offsets the impact of taxes on farm product sales. In Figure 15, a subsidy on fertilizer shifts the S_c and S_c + tax curves to the right to S_c' and S_c' + tax. This results in an increase in production to Q_5 and reduced import needs by $Q_5 - Q_3$. GOT tax revenue increases by $P_3HIG - P_3EFG$.

Figure 15 illustrates the conflict of the pricing policies on agricultural production. The illustration depicts a situation which existed in 1973 when the country was not self-sufficient in cereal production.

Figure 15. The Impact of Government Price, Tax, and Subsidization Policies on the Domestic Cereal Market.



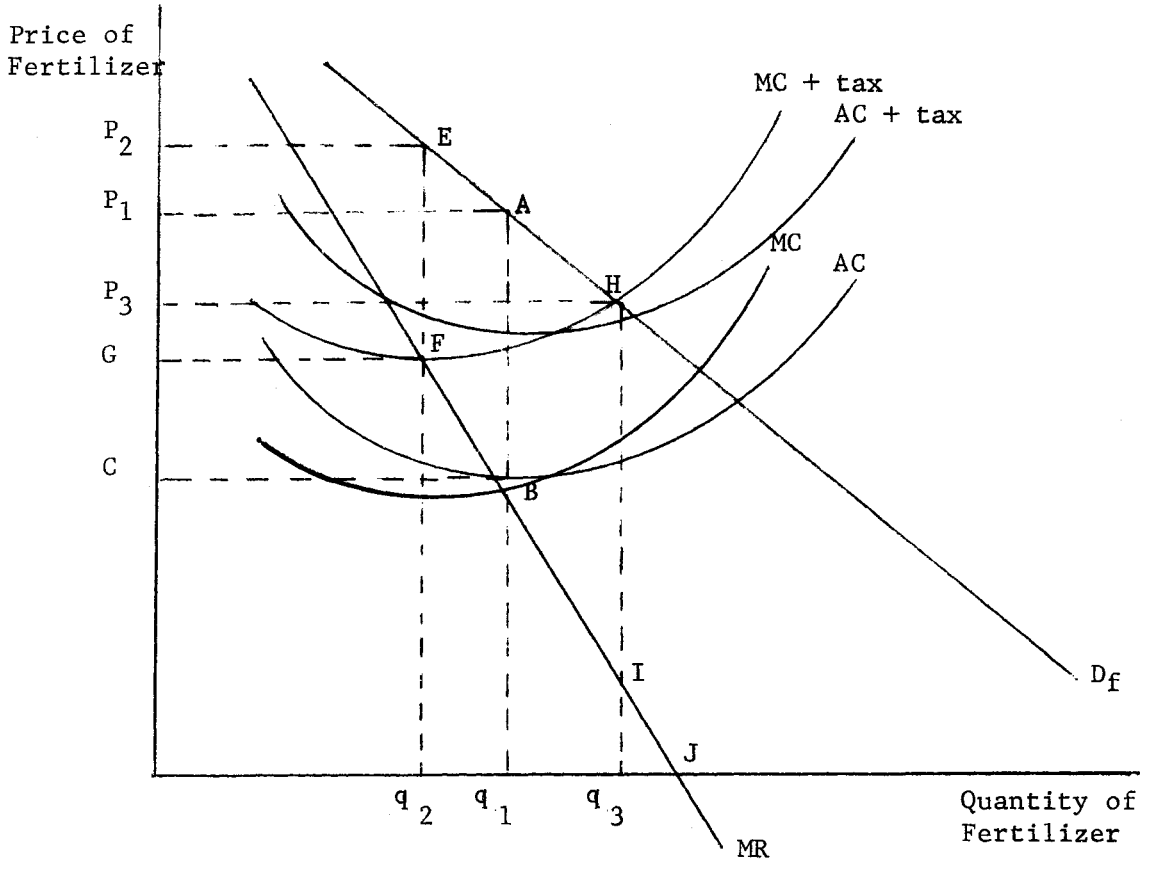
The government could have increased production and lowered imports by $Q_6 - Q_5$ if they chose to abolish the production taxes on cereal sales. An increase in the controlled price, P_3, would also result in increased production and lower imports. Reduced production and the low internal wheat price results in foreign exchange expenditures as cereals must be imported to meet domestic demand. Further, the government's tax revenue is used on expenditures for foreign supplies.

Impacts on Manufacturers and Importers

The government programs influence the levels of output and the return to importers and manufacturers of fertilizer. Since the number of these firms in Tunisia is small, the firm model for imperfect competition will be used for analysis. As a point of departure, consider

first the firm where no price controls, subsidies, or taxes are in effect. Here, the firm faces a downward sloping demand curve such as D_f in Figure 16. Since the demand curve is downward sloping, the firm's marginal revenue (MR) curve will lie below the demand curve. The MR curve represents the firm's marginal change in revenue as its level of supply or production changes. AC and MC represent the firm's average and marginal costs, respectively, at different levels of output.

Figure 16. The Impact of Production Taxes and Controlled Prices on Fertilizer Producers.



The firm, as a profit maximizer, will supply that quantity of fertilizer which equates MR and MC. At the profit maximizing output in our illustration, the firm supplies quantity q_1 at price P_1. The area P_1ABC represents excess profits. An imposition of a production tax raises costs and, consequently, the AC and MC curves shift

upward. 32/ With the higher cost, the firm reduces its supply to q_2 and price rises to P_2. Excess profits have been reduced by $P_1ABC - P_2EFG$, but at the expense of higher prices and decreased supply.

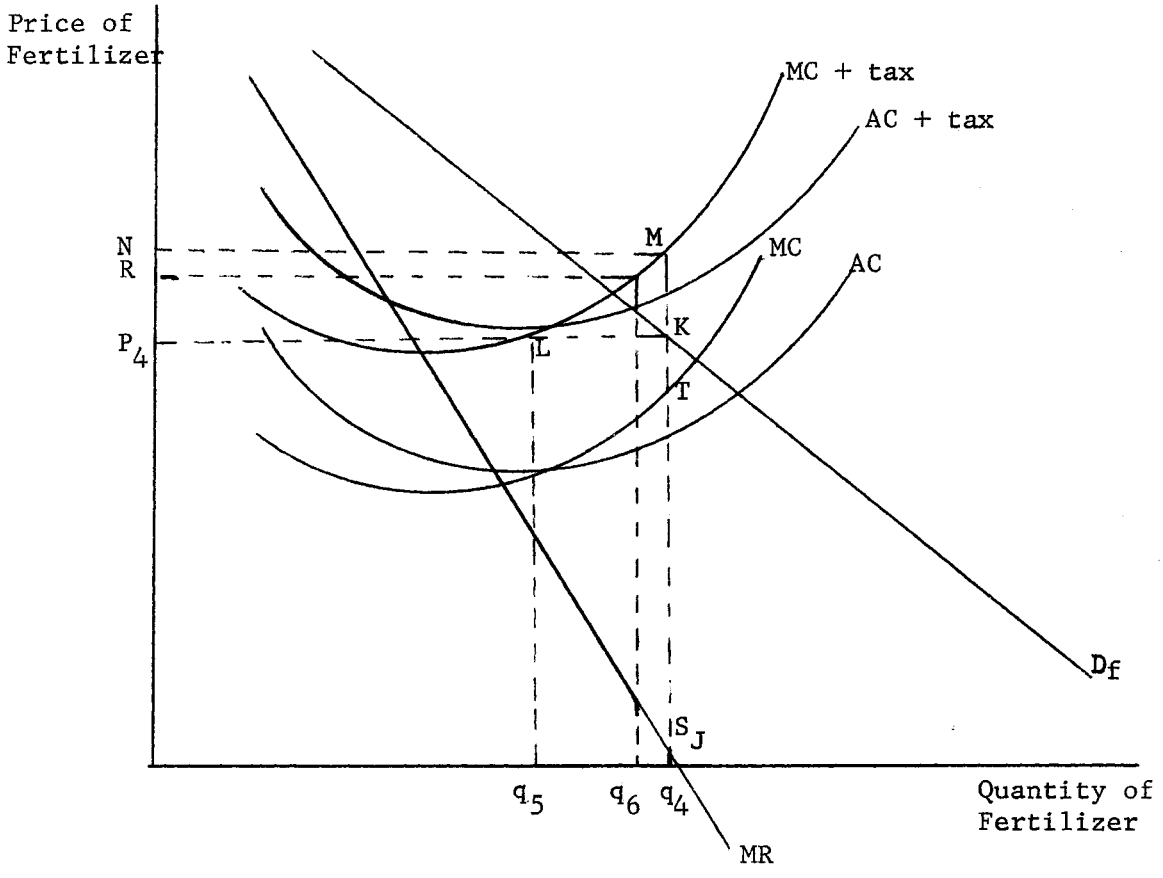
A price control policy can be used to increase supply and offset the production tax effect. The control policy must be used judiciously if supply is to be increased and if supply is to equal demand at the controlled price. In Figure 16, the controlled price could achieve increased supply and a reduction in excess profits if set between prices P_2 and P_3. At the price P_3, the allocation of resources to fertilizer production would be the maximum possible without inducing the firm to produce a smaller quantity than demanded, as the new MR curve, P_3HIJ, would equate MC with MR where it intersects the demand curve at point H.

At a higher or lower price than P_3, supply would be less. If the price were set between P_2 and P_3, the quantity supplied would be less than q_3; profits would be greater for the firm than at P_3, but supply would equal demand. A controlled price below P_3 would result in quantity demanded exceeding quantity supplied.

Subsidization of fertilizer producers or importers again complicates the analysis. The government must subsidize supply (production or importation) whenever the controlled fertilizer price is set below the point of intersection of the MC and demand curves if shortages are to be avoided. Figure 17 illustrates the case where fertilizer supply is both taxed and subsidized simultaneously. The firm's cost curves with the production tax are drawn as in Figure 16. We will first assume that the controlled price, P_4, is set below the firm's AC + tax curve. The MR curve in this case is P_4KSJ. At this price, the quantity demanded will be q_4. However, the firm will supply less, q_5, as its MC + tax curve intersects the MR curve to the left of the demand curve at point L. At P_4, the firm's average costs would not be covered and it will eventually be forced out of business. In the short run, quantity supplied will be less than demanded by $q_4 - q_5$. To avoid shortages, the government would have to subsidize the firm. To generate a supply of q_4, the subsidy payment of P_4N per ton of fertilizer would have to be paid. Total cost of the subsidy is represented on the graph by $NMKP_4$. A subsidy payment less than P_4N would result in fertilizer shortages. This can be observed by lowering the per unit subsidy payment to P_4R. At this level of subsidization, the firm would supply q_6 and a shortage of $Q_4 - Q_6$ would exist.

32/ For simplification of the analysis, we have considered the production tax as a fixed amount per unit. In reality, the tax is a percentage of the sales price (ad valorem tax). An ad valorem tax would shift the AC curve up also, but in a manner slightly different to that of a fixed tax per unit.

Figure 17. The Impact of Production Taxes and Subsidies on Fertilizer Producers.



The government could in this case eliminate its subsidy if the production tax is abolished. After the tax is abolished, the MC curve (without taxes) facing the firm intersects the vertical portion of the MR curve (P_4KSJ) at point T. At the controlled price P_4 and quantity q_4 would be supplied. Because in this case the subsidy per ton of fertilizer is less than the production tax by KT dinars, both the tax and the subsidy can be eliminated and the same level of fertilizer production would be forthcoming at the controlled price of P_4. Even if a tax were reduced to KT dinars per ton, no subsidy would be needed and quantity q_4 would still be forthcoming.

Other variations of the above analysis are possible. We have only attempted to show the complexity of setting prices by a government when the policy tools of production taxes and subsidy payments are in use. Actual application of these kinds of programs to the production and importation of fertilizer in Tunisia will require considerable knowledge of supply and demand characteristics.

V. SUMMARY AND RECOMMENDATIONS

Fertilizer Demand

The consumption of fertilizer increased 109 percent from 1966 to 1973 in Tunisia. Most of the increase came through expanded consumption of nitrogen, 356 percent, and continued increases in the use of phosphate fertilizers, 46 percent. The northern region of the country accounted for over 93 percent of the fertilizer consumption in 1973. Of the total fertilizer consumption, 54.3 percent was used on cereal crops (49.3 percent on wheat), 34.3 percent on garden crops, 11.3 percent on tree crops, and the balance on other miscellaneous crops.

Three fertilizers account for close to 90 percent of the fertilizer consumption: 33.5 percent ammonium nitrate accounted for 46 percent, normal superphosphate (NSP) 27 percent, and triple superphosphate (TSP) 20 percent. The cereal sector consumes approximately 50 percent of the ammonium nitrate and 70 percent of the NSP. Potassium and mixed fertilizers are used in Tunisia, but together they represent less than 13 percent of all consumption. They are used primarily on tree and garden crops.

The Ministry of Agriculture estimates national fertilizer consumption for each agricultural year within a framework of a series of development plans. The last two years, these estimates have exceeded actual consumption, in some cases, by over 50 percent.

To expand agricultural output through increased fertilizer use, the GOT initiated price controls at both wholesale and retail levels in 1970 on nitrogen and phosphate fertilizers. The controlled prices for nitrogen have been set below world prices (all nitrogen fertilizers are imported) and for NSP below the manufacturer's costs of production. Because retailers are permitted to add transport and handling costs to the fixed retail price, retail price fixing is rather loose.

The price control has meant large subsidy expenditures for the GOT. The GOT's budget in 1974 allocated 2,900,000 TD for the subsidization of nitrogen fertilizers and NSP. The 1974 budget allocation represented an increase of 61 percent over that of 1973.

The government levies taxes on the sale of agricultural products at the farm level and on the manufactured and imported fertilizers. Both counteract policies designed to expand fertilizer use. Agricultural production taxes are highest on cereals and major export crops. These taxes lower the price that a farmer receives for his commodities, thereby lowering his production incentives. The fertilizer production taxes have required higher subsidy payments. In 1973, the revenue generated by the fertilizer production taxes on ammonium nitrate and NSP was less than the government's subsidy payments to the importers and/or manufacturers of these two fertilizers.

In addition to the factors which influence fertilizer use through fertilizer or farm product prices, there are a number of other factors which affect its use:

(1) The variability in annual rainfall quantity and its distribution throughout the growing season causes considerable variation in optimum levels of fertilizer use, particularly nitrogen;

(2) There were reports of shortages of fertilizer at country distribution points at the time of application. The shortages appear to be the result of inadequate storage facilities at country points and reluctance of importers to import sufficiently in advance of the crop season;

(3) Although not examined rigorously in this study, there are indications that lack of credit for fertilizer purchases prevents some farmers from using fertilizer;

(4) There is also some evidence that many farmers may lack knowledge of the advantages of fertilizer use.

Fertilizer Distribution

The fertilizer distribution system is composed of national commodity offices and agencies, private and semigovernmental manufacturers, and independent and cooperative retailers. The phosphate market is controlled by STEC whose share capital is partly owned by the government. In 1973, STEC shared the nitrogen and potassium markets with SEPCM, a privately owned firm. The mixed fertilizer market is shared by STEC, SEPCM, and STIPCE (a privately owned firm). All of the nitrogen and potassium needs of the country are imported. All of the phosphate fertilizers are domestically produced. Mixed fertilizers are primarily domestically produced; however, small quantities were imported in 1973.

STEC controls 70 percent of the fertilizer supply in Tunisia through its wholesale/retail outlets. STEC, SEPCM, and STIPCE together control over 99 percent of the wholesale fertilizer supply.

To help maintain low fertilizer prices, the GOT subsidizes the firms that import nitrogen fertilizer and that produce phosphate fertilizers. However, the subsidy is paid only after domestic sales have been completed. This late payment, together with uncertainty of what costs the subsidy will cover (on nitrogen fertilizers), has undoubtedly lowered the firms' incentive to import nitrogen fertilizers. It may even have caused some shortages.

TSP was produced for the domestic market (1973) by one firm, SIAPE. In recent years, SIAPE has been a reluctant domestic supplier, as world TSP market prices have risen dramatically above the fixed domestic price.

In 1973, there were 280 fertilizer retail outlets in Tunisia of which 233 were located in the northern region. SEPCM, STIPCE, and STEC have four retail outlets. Except for STEC's outlet in Sfax, their retail outlets are located at their plants in Tunis. The cereal organizations (Office of Cereals, CCGC, and COCEBLE) operate 182 cereal centers throughout Tunisia. Almost all are potential fertilizer distribution points; however, in 1973 only 106 centers sold fertilizer. Fifty-seven percent of the centers selling fertilizer are located in the major cereal growing areas of Beja, Jendouba, Le Kef, and Tunis Sud. The independent and cooperative retail outlets number 170, 80 percent of which are located in the gouvernorats of Bizerte, Nebeul, and Tunis.

Fertilizer retail sales were 134,000 metric tons in 1973. SEPCM, STIPCE, and STEC accounted for 21 percent of the retail market. The cereal organizations controlled 43.6 of the retail market (the Office of Cereals alone controlled 25.4 percent). Their centers dominate the retail market in the major cereal growing areas. Less than one percent of the independent and cooperative retailers are located in Beja, Le Kef, Jendouba, and Tunis Sud. The independent and cooperative retail outlets are located primarily in the commercial vegetable growing areas. Together, they accounted for 35.4 percent of the retail market in 1973.

The official retail price policy for fertilizer provides for a great deal of leeway in the setting of retail price. Fixed prices are f.o.b. Tunis for nitrogen fertilizers and NSP and retailers can add transport and associated handling costs,which are not fixed. In general, competitive fertilizer pricing occurs in the vegetable growing areas of the country. Pricing patterns throughout the country are partially related to retail outlet concentration and the presence of cereal organization centers in an area (the cereal organizations sell fertilizer at cost). The highest prices and margins are those of independent retailers in the cereal growing areas.

Periodic fertilizer shortages occurred in Tunisia in 1973,mainly for ammonium nitrate. The independent and cooperatives in the vegetable growing areas experienced some difficulties in filling their orders at the wholesale level, but our survey found no general fertilizer shortages in these areas. Shortages were restricted to individual retailers. That there was no general shortage in these areas was further evidenced by an average independent retailer margin for ammonium nitrate that was very low - 4.6 percent of the wholesale price, lower than legally allowed.

Difficulties in filling orders and transporting fertilizer occur annually. The risk aversion practice of farmers purchasing their fertilizer needs immediately prior to fertilization encourages retailers to build up their inventories immediately prior to the fertilization periods and take delivery of the bulk of their fertilizer supplies during the fertilization periods. The cereal organizations, which account for 43.6 percent of the retail market, have adopted this practice because, during the harvest season, storage area is devoted to cereals. The Office of Cereals, in particular, has inadequate fertilizer storage space. Many of its centers store their fertilizer in the open.

Recommendations

The expansion of chemical fertilizer use can make a significant contribution to Tunisia's objective of self-sufficiency in food production. There appear to be a number of changes in the pricing and marketing of fertilizer which would expand its use. The following are changes and adjustments that should be made or evaluated with respect to expanding fertilizer use:

(1) The fertilizer production taxes could be abolished or reduced on those fertilizers manufactured or imported for domestic use. The government taxes fertilizer manufacturers and importers and then subsidizes them by a greater amount in order to encourage them to import or manufacture for domestic use. If taxes were discontinued, subsidy expenditures would decrease. Further, if the production taxes were abolished on TSP supplied to the domestic market, the manufacturers of TSP might not be as reluctant to produce for the domestic market.

(2) The use of TSP in place of NSP should be encouraged. This could be done by fixing the relative prices so that the cost advantage of using TSP is readily apparent to users. This might be accompanied by extension activities that show the advantages of using TSP. There could be a number of benefits from the shift: a reduction in the total storage and transport needed to market a given quantity of this nutrient and reduced subsidy payments to manufacturing firms, as well as reduced farmer purchase and application costs.

(3) More timely importation of nitrogen fertilizer supplies should be encouraged. This may require a number of programs. First, the import subsidy should be paid at the time of import rather than when the fertilizer is sold by the importer. This payment policy could be conditional on meeting an import time table and quota. The importer should also be assured of an adequate return. Second, loans to importers may be necessary to provide them with working capital while they

are holding fertilizer. Third, a credit program may be necessary to encourage the development of storage facilities to store fertilizer until it is moved into distribution channels.

(4) Fertilizer storage areas should be established in the major cereal growing areas. This could allow stock buildups prior to beginning of fertilizer application. Early ordering and storage of supplies could also alleviate some of the transport difficulties. Again, a special credit program to encourage the development of storage facilities may be required.

(5) The potential of expanding credit and extension programs for fertilizer should be studied. It should consider questions such as the lack of information on use, benefits of fertilizer use, and the extent to which credit shortages are limiting the use of fertilizer. This may require a survey of farmers.

VI. BIBLIOGRAPHY

Aide Memoire Fertilisation. Division de la Production Agricole, Ministère de l'Agriculture, République Tunisienne, mars 1970.

Budget Economique 1974, La Production. Bureau du Plan et du Développement Agricole. Ministère de l'Agriculture, République, Tunisienne, octobre 1973.

Bulletin Mensuel de Statistique. Institut National de la Statistique, various issues.

Campagne Céréalière 1972-73. Division de la Vulgarization Agricole, Direction de la Production Agricole, Ministère de l'Agriculture, septembre 1972.

Capitaine, R.C. Fertilisation Dans le cas d'un Type D'Assolement Céréalier en Tunisie. Annales de l'Institut National de la Recherche Agronimique en Tunisie, 1968.

Code Geographique. Institut National de la Statistique, République Tunisienne, decembre 1972.

Colloque sur la Production, la Distribution et l'Utilisation des Engrais. (Proceedings of Seminar), Sfax, Tunisia, 18 et 19 avril 1969.

Commercial Fertilizer Yearbook. Food and Agricultural Organization, United Nations. Rome, 1972.

Les Cooperatives Agricole en Tunisie, Structures et Difficultés. Revue Tunisienne, de Sciences Sociales, CERES, No. 26, septembre 1971.

Coursier, C. and Jeandrain, M. Rapport au Gouvernement de la Tunisie, Programme Engrais, FAO. Organization des Nations Unis pour l'Alimentation et l'Agriculture, Rome, 1972.

Dahl, R.P. Agricultural Development Strategies In a Small Economy: The Case of Tunisia. Staff Paper P 71-28, Department of Agricultural and Applied Economics, University of Minnesota, St. Paul, Minn., December 1971.

Dahl, R.P. International Trade and Price Prospects For Cereals and Their Implications to Tunisia. Staff Paper P71-24, Department of Agricultural and Applied Economics, University of Minnesota, St. Paul, Minn., November 1971.

Dahl, R.P. and Hyslop, J.A. Wheat Production in Tunisia: Trends and Variabilities. Staff Paper P70-9, Department of Agricultural and Applied Economics, University of Minnesota, St. Paul, Minn., June 1970.

Daves, Thomas E. Potentialités de Production et Besoins en Intrants d'Une Utilisation Complête des Resources d'Irrigation Existantes en Tunisie. Bureau du Plan et du Développement Agricole, Equipe de l'Université de Minnesota, Ministère de l'Agriculture, 15 juillet 1973.

Englestad, O.P. and Terman, G.L. Agronomic Evaluation of Fertilizers. Bulletin Y-21, Tennessee Valley Authority, Muscle Shoals, Alabama, March 1971.

Engle, R.A. Etude sur l'Utilisation et le Marché, des Engrais en Tunisie. United States Agency for International Development, Tunis, Tunisia, 1963.

Enquête Occupation du Sol. Institut National de la Statistique, Ministère du Plan, République Tunisienne, 1971, 1972.

Etude pour l'Elaboration d'un Programme Optimal pour l'Agriculture Tunisienne. Modèle, G, Piece III, Institut de Sciences Economiques Appliqué, Direction du Développement Agricole, Sous Secretariat d'Etat à l'Agriculture, Secretariat d'Etat et à l'Economie Nationale, Republique Tunisienne, 1968.

Fertilizers: An Annual Review of World Production and Consumption and Trade of Fertilizers. Food and Agricultural Organization, United Nations, Rome, 1972.

Grissa, A. Agricultural Policies and Employment: Case Study of Tunisia. Development Centre of the Organization for Economic Cooperation and Development, Paris, 1973.

Hammond, J.W. Characteristics of the Fruit and Vegetable Sector of the Tunisian Economy. Staff Paper P71-18, Department of Agricultural and Applied Economics, University of Minnesota, St. Paul, Minn., September 1971.

Hauri, Irene. La Révolution Verte en Tunisie. Institut d'Etudes de Développement Economique et Social, Tunis, mai 1973.

Johnson, W.F. Agricultural Sector Paper, Fiscal Year 1972. United States Agency for International Development, Tunis, Tunisia, February 1972.

La Presse. Tunis, Tunisia, Issues, 1973 - April 1974.

Lois et Réglements. Journal Officiel de la République Tunisienne, 113^{e} Année N^{o} 44, mardi 22 - vendredi 25 septembre 1970.

Lois et Réglements. Journal Officiel de la République Tunisienne, 117^{e} Année N^{o} 13, mardi 19 fevrier 1974.

The Marketing and Distribution of Fertilizer in Tunisia. Tennessee Valley Authority, National Fertilizer Development Center, Muscle Shoals, Alabama, November 1974.

Monthly Bulletin Agricultural Economics and Statistics. Volume 9, Food and Agricultural Organization, United Nations, Rome, 1974.

Nieunoudt, W.L., "Input Subsidies for Variable Resources in Agriculture." Canadian Journal of Agricultural Economics, Volume 20, No. 2, July 1972.

Organization de la Production: Deuxième Partie. Ministère de l'Agriculture, République Tunisienne, mars 1972.

Plan de Développement Economique et Social 1969-72. Volume 2. Secretariat d'Etat au Plan et a l'Economie Nationale, République Tunisienne, 1968.

Plan de Développement Economique et Social 1972-73. Secrétariat d'Etat au Plan et à l'Economie Nationale, République Tunisienne, 1971.

Plan Quadriennal 1973-76: La Production Agricole, Ministère de l'Agriculture, République Tunisienne, mars 1973.

Preparation du Plan Triennal 1973-75. Sous Comité des Intrants Utilisés en Agriculture, Ministère de l'Agriculture, République Tunisienne, 1972.

Production Yearbook. Food and Agriculture Organization, United Nations, Rome, 1970-72.

Purvis, M.J. Note: Towards the Definition of Economic Policy for Tunisian Agriculture. Ministry of Plan, Republic of Tunisia, June 1972.

Purvis, M.J. The Adoption of High Yielding Wheats in Tunisia. Staff Paper P72-7, Department of Agricultural and Applied Economics, University of Minnesota, St. Paul, Minn., February 1972.

Rapport Annuel. Projet Blé, 1970-71.

Revue Tunisienne d'Economie et de Statistique. Institut National de la Statistique, République Tunisienne, 1972.

Revue Tunisienne de Sciences Sociales, 8 eme Année, No. 26. Centre d'Etudes et de Réchèrches Economiques et Sociales, Tunis, Tunisie, septembre 1971.

Russel, D.A., Grisso, R.D., and Lee, R.G. Fertilizer Alternatives for Ghana. Bulletin 4-56, National Fertilizer Development Center, Tennessee Valley Authority, Muscle Shoals, Alabama, March 1973.

Shields, J.T. Trip Report: Fertilizer Situation in Tunisia. Tennessee Valley Authority, Muscle Shoals, Alabama, 1973.

Study of the Tunisian Grain Marketing System. Report No. 47, Food and Feed Grain Institute, Kansas State University, August 1974.

Tarif des Droits de Douane: A 1'Importation et à 1'Exportation. Journal Officiel de la République Tunisienne, 116e Annee No 34, Jeudi 13 septembre 1973.

Tunisia Nitrogen Fertilizer Needs, Alternatives to Meet Needs. Tennessee Valley Authority, Muscle Shoals, Alabama, 1968.

1974 Tunisian Acreage and Livestock Enumerative Survey. Volume 1 & 2. Statistical Reporting Service, U.S. Department of Agriculture, Washington, D.C., August 1974.

Tunisia. Les Guides Bleus. Librairie Hachette, Paris, France, 1971.

World Directory of Fertilizer Manufacturers. Second Edition, The British Sulfur Corporation, Ltd., London, 1972.